

The Ecology and Biogeography of the Butterflies of the Trinity Alps and Mount Eddy, Northern California

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Abstract. The butterfly faunas of the Trinity Alps and Mount Eddy, northern California, were investigated during five field seasons in the hope that they would shed light on the biogeographic history of the high-elevation biota of the Sierra Nevada. In particular, relict plants are numerous in the region, and bear on various scenarios advanced by phytogeographers for range changes of plants in the Pleistocene. The Trinities and Mount Eddy are the only non-Sierran, non-volcanic mountains in northern California reaching subalpine and alpine heights.

The total Trinity-Eddy fauna includes 112 species. This fauna was compared with various Sierran faunas and with that of Crater Lake National Park, Oregon. Most of the subalpine - alpine fauna is differentiated at the subspecies level between the Sierra Nevada and the Trinity-Eddy region, and there are no known populations of taxa previously regarded as "Sierran endemic." Two subspecies are endemic to the Trinity-Eddy subalpine region. Several others extend into Oregon. One, limited to Deadfall Meadow and Deadfall Lakes, is disjunct from the central interior Oregon Cascades. The montane fauna is less differentiated than the subalpine.

Numerous differences in ecology and altitudinal distribution occur between the Trinity-Eddy region and northern Sierra. The Trinity-Eddy phenology is generally later, with a peak in abundance and diversity in autumn.

The Trinity-Eddy fauna offers no evidence contrary to either northern or eastern distributional routes into the Sierra, but is more strongly supportive of the former. Several possible explanations of the character of the fauna are discussed.

Introduction

The Trinity Alps, located about 80 km northwest of Redding, California, form a rugged and relatively inaccessible terrain including the highest peaks in the Klamath physiographic province. With extensive areas above 2100 m and a maximum elevation of 2744 m, the Trinities include considerable subalpine and

limited amounts of alpine habitat situated roughly midway between the Pacific Ocean (about 100 km) and the Sierra Nevada - Cascade axis (about 115 km). This high country can be reached only on foot or horseback via the numerous trails in the Salmon - Trinity Alps Primitive Area, which is administered as wilderness by the U. S. Forest Service. To our knowledge the interior was visited only once by Lepidopterists before 1976. Yet the Trinity Alps are of great biogeographic and ecological interest for a number of reasons: they reproduce the complete set of altitudinal life zones characteristic of the west slope of the Sierra, but telescoped into a shorter and more abrupt elevational gradient; they receive exceptionally heavy precipitation which is seasonally more evenly distributed than in the high Sierra; they are an area of high botanical relictualism and endemism; they show abundant and dramatic evidence of Pleistocene glaciation; and they include an extraordinary edaphic diversity which is reflected in the vegetation up through the subalpine zone.

The fact that the Trinities provide potential habitats for the subalpine and alpine Sierran butterflies suggested their usefulness in testing a widely held (though not formally published) interpretation of the historical derivation of that fauna: that it came from the Rocky Mountains across the Great Basin in the Pleistocene. This is a familiar scenario in the literature of Sierran alpine botany (discussed further below). Because so few collectors had been into the Trinities, we quite literally had no idea what we would find. We determined to cover as many habitats as possible and over a period of several seasons. The Trinity Alps Project was inaugurated in June, 1976. By 1978 we realized that we would have to include Mount Eddy as the only potential "stepping stone" between the Trinities and the Sierra - Cascades. As our collecting progressed we became aware of the importance of the "arid" faunal component deriving from north and east of the mountains, and we made several forays down into Scott Valley. Ultimately the project involved 23 collectors for a total of over 200 man-days and over 700 km of trails and cross-country survey, resulting in an accumulation of over 5000 specimens of about 115 species, filling 17 Cornell drawers. At the end of August, 1979 the Pacific Slope Branch of the Lepidopterists' Society met at Davis and the meeting concluded with a field trip to the Eddies.

We are still not finished. In particular, the Deadfall Lakes and Mount Eddy have not been collected before July, so records of many spring species are missing from them. This hampers formal biogeographic analysis of the Eddies vs. the Trinities. The broad outlines of patterns have, however, emerged, and the data we know we are lacking are not of a sort likely to upset those patterns. We think it is now fair to say that the Trinities are better known Lepidopterologically than any area in the Sierra Nevada except the South Yuba River - Donner Pass region and Yosemite National Park.

Access to the Trinities requires a Wilderness Permit, which may be obtained at Redding, Mount Shasta City, Weaverville, or the Coffee Creek Ranger Station. Motorized vehicles are not permitted within the Primitive Area, or on Mount Eddy above Deadfall Meadow. Fire regulations are strictly enforced. We hope all Lepidopterists who may wish to visit this magnificent region will cooperate in preserving it in its primitive state for posterity.

The Trinities: The Physical Setting

Geography. -- The Klamath Mountains Province comprises an elongate, geologically complex area of approximately 30,560 km² in northwestern California and

southwestern Oregon. Among the named ranges are the Trinity, Scott, Scott Bar, South Fork, Salmon, Trinity Alps, Marble and Siskiyou Mountains. The Trinity Alps are centrally located in the Province and are mapped on the following USGS 15' topographic quadrangles: Helena, Trinity Lake, Coffee Creek, and Cecilville. Elevations range from 732 m near Trinity Alps Resort in the lower canyon of Stuart Fork to 2744 m at the summit of Thompson Peak, the highest point in the Province. The region is drained by the South Fork of the Salmon River and by the Trinity River, which has several major tributaries (North Fork, Stuart Fork, Canyon Creek, Coffee Creek) which head in the interior of the Alps. Most of the high country is contained in a circle of 13 km radius centered at 123°00' W, 41°00' N - an area of about 530 km². Approach is from California Highways 3 or 299. Many of the major trailheads are at or near Big Flat, on Coffee Creek Road which leaves Hwy. 3 northeast of Trinity Center. Other important trailheads are in the Stuart Fork and Canyon Creek drainages, respectively NNE and W of Weaverville. All the trails are shown on the Visitor's Map of the Trinity National Forest (North Half), available from the U. S. Forest Service. This map should be used in conjunction with the topographic quadrangles, as it is considerably more recent.

Climate. -- The climate of the Trinities is determined largely by westerly winds from the Pacific Ocean, and is of a montane - Mediterranean type modified by latitude and proximity to both the sea and the interior deserts of northeastern California and eastern Oregon. The only meteorological records made in the Alps proper are annual snow surveys compiled by the State Department of Water Resources. April readings for 1946 through 1967 indicate an average snow depth of 0.798 m with an average water content of 33.02 cm at Big Flat (1555 m), and 2.172 m and 97.54 cm on the south flank of Red Rock Mountain at 2013 m. Snow depths in the Caribou Basin are probably greater. In this very cold valley open to the north, frost may occur any night of the year and snow persisted at 2196 m into early August, 1976 in a year of below-normal snow pack. Midsummer high temperatures at 2100 - 2200 m range from 16 degrees - 27 degrees C in clear weather, with lows from 2 degrees - 10 degrees. Ferlatte (1974) states that the growing season at Big Flat "lasts from May to September" and is "proportionately shorter at higher elevations, probably limited to four or five weeks on the north side of Thompson Peak."

As is commonly the case in California, there are marked year-to-year variations in rain- and snowfall, growing season, and the timing of bad weather. Above 2200 m snowfall season is roughly mid-September through June. Because the Trinities are so far north, they are subject to frontal weather in summer which is uncharacteristic of the west slopes of the Sierra. Afternoon cumulus are of frequent occurrence and often mature into isolated thunderstorms. We, like all experienced Trinity campers, can testify to the violence of some of these storms, which may be accompanied by very cold downdrafts and hail. In some locations over 165 cm of orographic precipitation may fall in a year in the Trinities.

There are several "permanent" ice fields or glacierets in the Trinities, the most important of which (covering 2-2.5 ha each) are on the north side of Thompson Peak at 2500-2600 m. Smaller, semi-permanent ones occur elsewhere, as on the northwest side of Sawtooth Ridge, above the Caribou Basin. The persistence of this ice reflects both the heavy precipitation and sheltering in the shadows of the highest ridges.

Lithology. -- For their area, the Trinity Alps are extraordinarily complex (Irwin, 1960; Davis *et al.*, 1965). The three major rock types represented are pre-Jurassic metamorphics, Upper Jurassic - lower Cretaceous quartz diorites (granitics), and ultrabasics (ultramafics), mostly altered to serpentine. All of these exercise a great deal of control over soil and vegetation development.

The metamorphics are divided into three formations based on structural relationships and mineral composition: the Grouse Ridge Formation, consisting of micaceous quartzite, amphibolites, calc-shists, and impure marbles; the Salmon Formation of albite - epidote - hornblende schists; and the Stuart Fork Formation of metachert, micaceous quartzite, marbles, mica, greenstone and graphite phyllites. For the most part these rocks occur at low elevations, well within the montane zone; they reach their maximum elevation, and only penetration of the subalpine, at Packer's Peak (2387 m).

There are several bodies of granite in the Trinity Alps (Hotz, 1971). These are the Deadman Peak, Middle Fork, Canyon Creek, Caribou Mountain, Gibson Peak, Horseshoe Lake, Sugar Pine, Craggy Peak, and Russian Peak Plutons. The dominant plutonic rock is quartz diorite, but granodiorite occurs in the Russian Peak Pluton, north of the Alps proper. Most of the highest country is the Canyon Creek and Caribou Mountain Plutons. The distinctive landscapes of this country give the range its name and reputation for ruggedness.

Ultrabasics (ultramafics) occur only in the eastern half of the Alps, where they are the predominant rocks. They reach the subalpine level in a number of places, notably at Red Rock Mountain (2395 m) and throughout the Sunrise Creek - Landers Creek - Parker Creek - Union Creek area above 2100 m. The color of the ultrabasics - reflecting the mineralogy - varies greatly, from dull reds and ochres to blues and greens. The greatest local diversity occurs at Dorleska Summit (2135 m).

The contrasting colors and textures of Trinity rocks facilitate the tracing of glacial deposits to their sources (Sharp, 1960). They also facilitate correlation of vegetation types with soils. There are many dramatic contact zones, such as that between pre-Silurian metavolcanics (red) and quartz diorite - tonalite (white) (Caribou Mountain Pluton), which runs down Sawtooth Ridge and across Caribou Lakes.

The major valleys are filled with Quaternary glacial deposits and alluvium. Coffee Creek has huge piles of dredge tailings from gold mining operations earlier in this century. Both placer and hardrock mining were common. There are still some active gold claims in the region.

Structural History. -- In the late Jurassic (Lipman, 1962) the Alps were subjected to regional folding and metamorphosis and intruded by granitic and ultrabasic plutons. This period of tectonism and intrusion may be related to the formation of the ancestral Sierra Nevada. In late Cretaceous-early Tertiary time (MacGinitie, 1937) the landscape was worn down to a low relief, the so-called Klamath penepain, with maximum elevations of 750-1500 m; the late Jurassic intrusives may have been first exposed at this time. Regional tectonism recommenced in the late Pliocene-early Pleistocene, with a westward tilting, resulting in highest elevations in the eastern part of the range (Irwin, 1960). Antecedent streams were rejuvenated and began cutting down the steep, narrow canyons characteristic of the lower elevations today. Much of the drainage in the Trinities is transverse to the trend of the mountains. Lipman (1962) discusses the effect of the plutons on the drainage

pattern. The late Tertiary-early Quaternary uplift set the stage for the glaciation of the high country.

Glaciation. -- Sharp (1960) describes evidence for at least four substages of glacial activity in the Pleistocene Trinity Alps. Pleistocene histories in western North America are currently undergoing widespread re-evaluation in the light of the more complex chronologies derived from deep-sea sediment cores, and Sharp's scenario will probably need to be revised. He sees one stage as pre-Wisconsinian, perhaps as old as Kansan, with the others all being of Wisconsinian age. Sharp also feels that earlier glaciations may have occurred, as well as "neoglaciation" in the past 2000 years or less. He describes evidence for sheets of ice ("ice carapaces") 60-90 m thick, extending from the glaciers to the "schrund" lines below the ridge crests in the broad upper reaches of many of the valleys. "Bergschrundung" produced the steep cliffs, 15-90 m high, which are characteristic of the high granite country and make cross-country travel so difficult. Below them the canyon walls slope much less steeply down. The granite country has many classic glacial features, including striae and numerous cirques. In the ultrabasic country U-shaped valleys are well-developed (Sunrise, Parker, Union Creeks).

Moraines occur in all the major valleys, with debris flows below them in the valleys draining from ultrabasics. During the last ("Morris Meadow") glaciation the Alps contained at least 30 valley glaciers, extending down to about 1120 m; earlier stages had reached 750 m. Wisconsinian orographic snowline is interpreted as 1980 m, climatic snowline at 2440 m, as against modern values of 2290 m and 2745 m. Most of the present montane coniferous forest was probably subalpine during these maxima.

The Trinities: Vegetation

Ferlatte (1974) discusses the history of botanical studies in the Trinity Alps and attempts an ecological classification of plant formations there, recognizing five major zones. His book is a very valuable floristic reference but fails to convey much of an impression of the structure of plant communities or the degree of edaphic determinism in the vegetation. A regional survey of Klamath vegetation (Sawyer and Thornburgh, 1977) gives a coarse-grained impression of Trinity plant communities in a comparative context, and underscores the edaphic influences. The material which follows is a composite from these sources and our own qualitative observations. The definitive work on Trinity vegetation has yet to be written.

Ferlatte recognizes the following zones:

Mixed Conifer Forest. - This is the lowest, described as "found on the valley bottoms and lower slopes of adjacent ridges" at 1550-1830 m. It is an ecotone between lower and higher-elevation species and includes Yellow Pine (*Pinus ponderosa*), Sugar Pine (*P. lambertiana*), Lodgepole Pine (*P. contorta* ssp. *latifolia*), White Fir (*Abies concolor*), Douglas Fir (*Pseudotsuga menziesii*), and Incense Cedar (*Calocedrus decurrens*). Understory species noted are *Viola sheltonii*, *Claytonia lanceolata* and *Lewisia nevadensis*, all spring species; *Orthocarpus copelandii* and *Haplopappus bloomeri*, fall species; also *Adenocaulon bicolor*, *Amelanchier pallida*, *Spiraea douglassii*, *Clintonia uniflora*, and *Pyrola picta*. This description seems predicated on the vicinity of Big Flat: "Snow has usually melted by early June, and different species can be found in flower from May to September."

Red Fir Forest. - Described as occupying "essentially a transition zone" with elevations of 1675-2135 m; "snow often remains until the end of June." Tree

species are Jeffrey Pine (*Pinus jeffreyi*), Western White Pine (*P. monticola*), and Red Fir (*Abies magnifica* var. *shastensis*). Understorey species include *Ribes nevadense*, *Leucothoe davisiae*, *Lupinus croceus*, *Veratrum viride*, and *Ligusticum californicum*.

Subalpine Forest. - Elevational range 2135-2595 m; "snow can last throughout the year in protected places;...occurs mainly along the summits of the higher ridges and in the higher basins." The trees listed are Foxtail Pine (*Pinus balfouriana*), Whitebark Pine (*P. albicaulis*), and Mountain Hemlock (*Tsuga mertensiana*). Associated species include *Arctostaphylos nevadensis*, *Anemone occidentalis*, *Kalmia polifolia* var. *microphylla*, *Phyllodoce empetriformis*, and *Cassiope mertensiana*.

Alpine Fell - Field. - This zone is said to occur on north-facing slopes above 2595 m, with a short growing season reaching its peak in mid-August. Characteristic species are listed as: *Saxifraga tolmiei*, *Sibbaldia procumbens*, *Ranunculus eschholtzii*, *Primula suffrutescens*, and *Oxyria digyna*. The type locality is the north side of Thompson Peak.

Montane Chaparral. - Reported by Ferlatte at 1550-2135 m on exposed, well-drained, gravelly slopes in the canyons of Coffee Creek, the South Fork of the Salmon River, and Canyon Creek. "Snow has melted by early May." Shrubby dominants are listed as *Quercus vaccinifolia*, *Ceanothus velutinus*, *Arctostaphylos patula*, and *Garrya fremontii*.

Sawyer and Thornburgh treat this classification as unduly simplified, and we agree. For one thing, the "zones" are by no means as distinct as Ferlatte's telegraphic generalizations imply - they really consist of complex mosaics of local communities along environmental gradients. Ferlatte's text also obscures the climatic gradient across the Trinities which reflects increasing continentality north- and eastward, and the rain shadow of the mountains themselves. Sawyer and Thornburgh have discussed this gradient and its effects on forest vegetation. We will limit ourselves to detailed discussion of non-forest (bog meadow) habitats of particular interest to butterflies and butterfly collectors, and to the subalpine and alpine zones, with emphasis on edaphic control of the vegetation. It should be understood that Ferlatte's *Flora* omits many species, including even some common ones like *Chrysothamnus nauseosus*; some of these are cited in our text. A revision of Ferlatte is in preparation (J. diTomaso, pers. comm.). The book is, however, essential for field work in the Alps.

The Bog Meadows. - Moist or wet meadows and bogs are frequent in the montane and subalpine Trinity Alps. Their vegetation has not been described in detail. They occur on both granitic and ultrabasic substrates, and their floras differ almost completely between the two.

The most extensive boggy areas on granitic substrates are in the Caribou Basin at about 2085 m. The herbaceous vegetation is extremely diverse. Some characteristic species are *Erigeron peregrinus* ssp. *callianthemus*, *Aster alpigenus* ssp. *andersonii*, *Ligusticum californicum*, *Anemone occidentalis*, *Gentiana newberryi*, *Allium validum*, *Lilium washingtonianum*, *Schoenolirion album*, *Veratrum viride*, *Habenaria sparsiflora*, *H. unalascensis*, *Listera convallarioides*, *Spiranthes romanzoffiana*, *Luzula parviflora*, *Carex spectabilis*, *Deschampsia atropurpurea*, and *Cystopteris fragilis*. Twinberry (*Lonicera conjugialis*) and several willows occur, but most characteristic are the Ericaceous shrubs forming a transition zone to adjacent

Mountain Hemlock forest: *Phyllodoce empetrifomis*, *Vaccinium arbuscula*, and *Ledum glandulosum* var. *californicum*.

Only two conspicuous herbs which occur on granitic bogs also occur on ultrabasic ones: *Dodecatheon jeffreyi* and *Senecio triangularis*. Although granitic bogs are mostly on stream terraces and valley fills, ultrabasic bogs often occur on hillsides where semi-permanent seeps produce continually wet soils which support a distinctive plant community. This is related to what Hickman (1976) calls the *Caltha biflora* - *Carex sitchensis* - *Dodecatheon jeffreyi* community in the Oregon Cascades. The most characteristic plant of ultrabasic bogs in the Trinity is California Pitcher Plant (Cobra Plant), *Darlingtonia californica*. Ericaceous shrubs are completely absent. Some other characteristic species are: *Cirsium breweri*, *Helenium bigelovii*, *Raillardella pringlei*, *Lotus oblongifolius* var. *nevadensis*, *Dicentra pauciflora*, *Polygonum bistortoides*, *Caltha howellii*, *Gentiana calycosa*, *Trifolium longipes*, *Carex* ssp. (*hassei*, *interior*, *jonesii*, *lemmonii*, *scopulorum*, *teneraeformis*), *Scirpus criniger* and *microcarpus*, *Agrostis alba*, and *Nartheceium californicum*. Almost invariably the fringes of the bog, which dry in summer, are ringed by Bushy Cinquefoil (*Potentilla fruticosa*).

The serpentine seeps which run all summer make these habitats islands of green in a drying landscape. In September they turn a characteristic rusty color.

Subalpine and Alpine Vegetation. - The most characteristic subalpine tree on non-ultrabasics is *Pinus albicaulis*. It dominates in exposed sites on ridge crests, summits, and SW-facing slopes above 2200 m. Since this tree occurs to the virtual top of the Trinity, Sawyer and Thornburgh do not accept Ferlatte's claim of a climatic tree line. They attribute the "fell-fields" to poor soil development. *Tsuga mertensiana*, *Pinus monticola*, *P. contorta* and *P. jeffreyi* all occur in some stands. *T. mertensiana* forms almost pure stands in the Caribou Basin. *Polemonium pulcherrimum* and *Draba howellii* are two characteristic herbaceous components of the subalpine community.

On ultrabasics *Pinus balfouriana* is overwhelmingly dominant, with *P. monticola* as a consistent associate. A typical stand is at Sunrise Pass (2100-2300 m). The understory includes scattered clumps of *Arctostaphylos nevadensis* and *Quercus vaccinifolia*. Common herbs are *Astragalus whitneyi* ssp. *siskiyouensis*, *Castilleja arcanoides* and *aplegatei*, *Orthocarpus copelandii*, *Lomatium macrocarpum*, *Epilobium obcordatum* ssp. *siskiyouense*, *Aster ledophyllus*, *Sitanion hystrix*, *Oxyria digyna*, *Linum lewisii*, *Crepis pleurocarpa*, *Lupinus croceus*, *Phlox diffusa*, and *Arenaria nuttallii* ssp. *gregaria*. The overall aspect of the high Red (ultrabasic) Trinity is very different from that of the White (granite) Trinity: the widely-spaced trees, often gnarled and bizarrely shaped, and the floristically rich though sparsely vegetated understory produce a profound visual impression.

Packer's Peak, the only metamorphic mountain reaching the subalpine zone, is also vegetationally unique in harboring *P. balfouriana*, *P. albicaulis*, and *T. mertensiana* all in one place. There also a very rich shrub flora, including *Cercocarpus ledifolius*, *Holodiscus microphyllus*, *Ceanothus velutinus*, *Chrysothamnus nauseosus*, *Haplopappus bloomeri*, and *Purshia tridentata*. The herbaceous flora is also diverse, containing elements of both the granitic and ultrabasic floras, including the extremely rare endemic *Penstemon tracyi*.

Space prohibits further discussion of the structure of Trinity Alps vegetation. Because few of the butterflies are very narrowly restricted altitudinally and because

so large a proportion of the fauna is associated with non-forested habitats, we have adopted only a very loose "zonal" system of reference which recognizes foothill (including riparian canyon), montane coniferous forest (Ferlatte's "Mixed" plus "Red Fir"), subalpine, and alpine. See "Zonal Relationships," below.

Mount Eddy

Mount Eddy (2738 or 2750 m, two figures recently quoted) is the highest ultrabasic peak in northern California and has been mapped in both the Klamath and Cascade Provinces. It is part of the ultrabasic Trinity Pluton which includes much of the Trinity Divide. The summit (122°27'W, 41°20'N) is 27.4 km WSW of Mount Shasta and 59.6 km ENE of Thompson Peak. It is separated from the Trinity Alps by the lower, but still rugged, Trinity Divide which penetrates the subalpine zone barely at Gumboot Butte (2048 m).

Being farther east than the Trinities, Mount Eddy receives less rainfall. This is reflected in the conspicuous dominance of *Artemisia tridentata* from Deadfall Meadow up to tree line. This plant, which is completely absent from the Trinities, forms an understory in Red Fir forest, pure stands on sandy benches and arid slopes at Deadfall Lakes, and a distinctive association with *Cercocarpus ledifolius* in the subalpine zone, most conspicuously on the south slope of the south arm of Mount Eddy. The uppermost subalpine forest is almost identical in aspect to that of the Red Trinities, composed of *Pinus balfouriana* and *P. albicaulis*. It is very open and its understory grades insensibly into alpine fell-field, which is undisputably present on Mount Eddy. Above tree line the vegetation includes *Astragalus whitneyi* ssp. *siskiyouensis*, *Epilobium obcordatum* ssp. *siskiyouense*, *Eriogonum alpinum*, *Campanula scabrella*, *Hulsea nana*, *Cirsium drummondii*, *Crepis pleurocarpa*, and *Draba aureola*. At the very summit there are large prostrate mats of *Potentilla fruticosa* in a unique alpine habit.

A flora of Mount Eddy is available (Whipple and Cope, 1978), prepared as a tool for defining a Research Natural Area; 11 of 48 proposed "sensitive" (rare, endangered, or endemic) plant species in the Shasta - Trinity National Forest occur there.

From Deadfall Meadows to about 2350 m occur a series of boggy meadows of the ultrabasic type, vegetationally similar to those in the Red Trinities. They share the rare endemic Composite *Railardella pringlei*. Some of the hillside-seep bogs on Mount Eddy are larger than any in the Trinities and are especially striking because they occur adjacent to almost pure sagebrush.

Scott Valley

Scott Valley lies in the rain shadows of the Trinities, Mount Eddy, and Mount Shasta, which allow for a major southwestward penetration of Great Basin vegetation into California. The floor of the valley is mostly agriculturalized, with a few relict sedge marshes. The natural vegetation is described by Vasek and Thorne (1977). Because exposure and the airstreams around the mountains play so critical a role here, bizarre mixtures and juxtapositions of vegetation types are common. The dominant shrubs are *Juniperus occidentalis*, *Purshia tridentata*, and *Chrysothamnus nauseosus*. *Artemisia* is mostly lacking, although it is common north of Mount Shasta. On moister sites juniper mixes with and intergrades to *Pinus ponderosa* - *P. jeffreyi* - *Quercus garryana* forest; the same sequence is repeated on the approach to Mount Eddy from the north, on Stewart Springs Road. *Ceanothus cuneatus* occurs as an understory and successional plant with this forest. North from the Edgewood -

Gazelle area there is an extensive treeless grassland. Apart from low precipitation, winters north of the mountains are much colder than at comparable elevations to the south.

Phytogeography of the Trinity - Eddy Region

Stebbins and Major (1965) divided California into ten biotic provinces and examined the distribution of relict plant taxa among them. They found two major centers - the Klamath Mountains and the north and west borders of the Colorado Desert - which each accounted for 26-30% of all the relicts in the state. The high degree of relictualism and endemism in the Klamath Mountains has been known for many years. The predominant group of relicts is of Arcto-Tertiary derivation (Axelrod in Munz, 1970). Whittaker (1960) pointed out that relictualism and endemism in the Siskiyou Mountains were related to climate and soils. The two are best considered together. "Serpentine (ultrabasic) endemism" has generated a very large literature (Proctor and Woodell, 1975, present a 16-page bibliography) and only a very brief sketch of the origins and role of the phenomenon in the Trinity - Eddy flora is possible here. Ultrabasic endemics fall into two groups: those which evolved *in situ* on ultrabasics and those whose present distribution is relictual from a previously wider distribution on non-ultrabasics. Kruckeberg (1969) accounts plausibly for the evolution of plants of the former type by a sequence of adaptation to serpentine, depletion of "biotopes," and differentiation of local populations. This is a suitable model for herbaceous genera like *Streptanthus* (Cruciferae). It need not apply to woody taxa like Sargent Cypress (*Cupressus sargentii*) or Serpentine Scrub Oak (*Quercus durata*), which have a paleobotanical record clearly establishing a former widespread range on non-ultrabasics. Understanding the present restriction of these plants to serpentines may require integration of Pleistocene climatic change into the picture. Axelrod (1977, p. 152) reviews several taxa, showing what he interprets as a process of retreat into low-competition (ultrabasic) habitats as climatic change tilts the competitive balance away from formerly successful species.

Axelrod (1977, pp. 154-157) also interprets the high montane and subalpine relict trees of the Klamath Province in Quaternary terms: "Their presence appears to reflect the gradual shift southward to a shorter precipitation season, less summer rain, and greater ranges of temperature which increase drought stress." It seems plain that the frequency of cloud cover and summer rain has been a controlling factor in Quaternary and Recent plant distributions in California. One of the most intriguing relicts in the state is Foxtail Pine, *Pinus balfouriana*, a characteristic subalpine tree on ultrabasics in the Trinity - Eddy region (it occurs on Lake Mountain, Russian Peak, Scott Mountain, Mount Eddy, Eagle Peak, Red Rock Mountain and Sunrise Pass, Packer's Peak, Gibson Peak, and North Yolla Bolly, 2000-2750 m) which occurs disjunctly in the southern Sierra Nevada at 2600-3660 m on shallow decomposed granite soils in Tulare and Inyo Counties (Mastrogiuseppe, 1972). Axelrod notes that some herbaceous associates show related distributions, sometimes as species pairs. He concludes that the presence of *P. balfouriana* and similar species "in the southern high Sierra Nevada seems related to the fact that there is considerably more warm season precipitation there than in the central Sierra. Farther north the Sierran axis is so low that subalpine environments are highly restricted. Sites there were strongly affected by the Xerothermic, which may have eliminated possible intermediate links between the Klamath and southern High Sierra regions."

Despite the concentration of endemics in the Klamath Province, the actual numbers of species involved are low. Thus, of 571 vascular plants recorded in the Trinity Alps by Ferlatte, only 7 were strictly endemic to the Klamath Province; 4 of these also occur on Mount Eddy (Whipple and Cope, 1978). Phytogeographic analysis in Ferlatte's book is restricted to one paragraph on p. 9, which is worth quoting in its entirety: "The flora of the Trinity Alps is generally typical of the high mountains of California: 77% of the species collected occur in the Sierra Nevada; and 84% extend at least to Oregon with many species reaching as far north as Alaska. There is some influence from the east with 17% occurring in northeastern California and 13% ranging as far as the Rocky Mountains; 12% reach the southern limits of their ranges in northwestern California without occurring in the Sierra Nevada; and 8% of the species collected are restricted to California. The presence of species like *Arnica viscosa*, *Claytonia nevadensis*, *Haplopappus lyallii*, *Picea breweriana*, and *Pinus balfouriana* suggests that some elements of the flora may represent relicts of older populations that existed in past, cooler climates."

The past changes in distributions of organisms are complex, and the interpretation of relicts not necessarily straightforward. Some are easier than others. *Hulsea nana* is restricted in California to Mounts Lassen, Eddy, Shasta and Goosenest. It is widespread in the Cascades (Hitchcock and Cronquist, 1973), north to Mount Rainier, and in the Wallowa Mountains (Munz, 1970). *Campanula scabrella* is known in California only above tree line on Mount Eddy, but occurs in the Oregon and Washington Cascades and east to Idaho and Montana (Hitchcock and Cronquist, 1973). *Astragalus whitneyi* is isolated on serpentine on Mount Tedoc, Tehama County, where there is also a strict endemic *Haplopappus (ophitidis)* very closely allied to *H. bloomeri*. Other species occur disjunctly in the Trinity bogs and bog meadows and in the very isolated bogs and bog meadows of the Yolla Bollys and North Coast Range, including Plaskett Meadows (Hemphill, 1952, 1971). All of these relicts can be interpreted in terms of northward retreat of a flora basically incapable of dealing with lack of summer rain, a process Axelrod and Daubenmire (1977) find important in the evolution of the Californian and Pacific Northwest floras, respectively. Inferring directionality from Klamath - Sierran disjunctions is much more difficult. Ferlatte found several species in the Trinities hitherto reported in California only in the Sierra Nevada. If we consider the alpine and subalpine taxa, *Arnica mollis*, *A. amplexicaulis*, *A. diversifolia*, *Artemisia norvegica* var. *saxatilis*, *Lupinus lyallii*, and *Carex scopulorum* all occur in the Cascades, usually far northward; *Carex proposita* has a spotty distribution in central Idaho and the Wenatchee Mountains, Washington; and *Saxifraga bryophora* is unrecorded outside California. To what extent can we infer from the presence of these species in the Trinities that they colonized the Sierra from the north? Howell (1944) found similar disjunctions between the Marble Mountains and the Sierra, and Clark (1972) gives additional ones from the Siskiyoues. We will return to the origins of the high-altitude Sierran flora and its relationships with the Trinity - Eddy area in the discussion of butterfly biogeography, below.

Miller (1951) analyzed the avifauna of the Californian biotic provinces and found the largest "boreomontane" component in the Klamath region. His overall analysis mirrors Ferlatte's for the sources of the Trinity flora. Given the assumption of higher dispersability in birds than in most plants, the similarity suggests current rather than past ecological regimes as the greater control on the distributions of both.

Butterflies are intermediate between plants and birds in dispersability; like birds they are often interested in the structure of vegetation, but unlike birds they commonly are tied to one or a few specific plant species. Comparisons among the three groups should, then, be instructive.

The Problem of the Sierran Alpine Biota

How does an alpine biota originate? Speaking of alpine floras, Chabot and Billings (1972) said: "The Sierra Nevada of California is one of the few situations where such a question may reasonably be studied. In this young mountain range the areas of alpine habitats are extensive, and the well-developed alpine flora is uniquely composed of a large endemic and locally derived element and a relatively small cosmopolitan arctic-alpine group (Major and Bamberg, 1967). A floristic array so truly alpine and with such a small arctic component does not occur in any other North American mountain system."

Do these characteristics pertain to the Sierran alpine butterfly fauna? For Yosemite National Park, Garth and Tilden (1963) list 51 species as resident in either the "Arctic-Alpine" or "Hudsonian" (alpine and subalpine) life zones. Where does this fauna come from? There are three plausible sources which could contribute to it: evolution *in situ* from pre-existing regional lowland sources; invasion from the north during the Pleistocene; and invasion from the Rocky Mountains across the Great Basin. The third of these is least familiar to entomologists, though it has generated a lively controversy among phytogeographers. It emerged with the publication (Major and Bamberg, 1963, 1967) of the Convict Creek flora. In this subalpine limestone drainage on the Sierran east slope in Mono County occur *Arctostaphylos uva-ursi* at its only station in the range, *Draba nivalis* var. *elongata*, *Kobresia myosuroides*, *Salix brachycarpa*, and *Scirpus rolandii*, the last four not known elsewhere in California, but disjunct from the Rockies, the eastern Great Basin, and the Wallows - North Cascades. *Pedicularis crenulata* occurs at its only California station near the mouth of Convict Creek, disjunct from the Rockies. Major and Bamberg proposed that this extraordinary constellation of relicts marked a Pleistocene dispersal track from the Rockies to the Sierra via the Great Basin, perhaps in boggy swales similar to modern subalpine meadows; they envisioned a Great Basin cold steppe similar to modern climates in central Asia. This would allow for direct biotic enrichment of the high southern Sierra without postulating that elements shared with the geologically much older Rocky Mountains were derived by migration from the north.

Major and Bamberg's hypothesis has not been enthusiastically received. Chabot and Billings (1972) felt that the entire Convict Creek assemblage came from the north and persisted on the unusual soils of that basin because of a lack of competition from the dominant flora of the granodiorite of the remainder of the range. Raven and Axelrod (1978, p. 63) concur: "There is so little similarity between the flora of the Sierra Nevada at large and that of either the northern or southern mountains of the Great Basin that such a path of migration appears highly unlikely. The decreasing proportion of Rocky Mountain species southward in the Sierra Nevada, coupled with the increasing proportion of endemism (Stebbins and Major, 1965), accords much better with a pattern of migration from the north." Earlier, Axelrod (1976, p. 34-37) discussed the matter in great detail and concluded that paleontological evidence does not support the postulated cold-steppe climate required by Major and Bamberg, and that acceptance of their hypothesis would

create far greater problems than it solved. However, Major and Taylor (1977) review the alpine floras of California and conclude that the Great Basin dispersal route must be considered still a possibility.

Quantitative similarities among various Far Western alpine floras, from Alaska to southern California, are presented by Major and Taylor in the form of a plexus diagram (1977, fig. 18-1, p. 612) combining data from a variety of sources. Using Sorensen's (1948) coefficient of similarity, a derivative of Jaccard's (1902) coefficient of community, they show that "three major floristic units are apparent: a North Cascade, a South Cascade, and a Sierra Nevada unit. Of the California localities, the alpine flora of the high peaks of the Klamath Mountains is more similar to that of the Northern Cascades than to that of either of the Southern Cascade volcanoes, Mount Shasta and Mount Lassen, or to the Sierra Nevada. Several important Pacific-Cordilleran species, like *Saxifraga caespitosa* and *Haplopappus lyallii*, are known to occur in California only in the Marble Mountains and Trinity Alps. Mount Shasta and Mount Lassen are most similar floristically to the other inland southern Cascade volcanoes, Mount Mazama (Crater Lake) and the Three Sisters. The Sierran alpine flora is a distinctive unit, largely because of the high proportion of endemic species.... Chabot and Billings attribute the present composition of the alpine flora of the Sierra to six predominant variables (1972, p. 174): (1) recent uplift of the range, (2) isolation of the range from preexisting sources of alpine species, (3) restriction of species migrations by Pleistocene glaciations and (4) by post-Pleistocene climatic shifts, (5) mixing and telescoping of alpine and desert floras during Pleistocene migrations, and (6) the present summer aridity of the Sierran alpine climate." They also reproduce (table 18-2, p. 610) a breakdown of the phytogeographic affinities of the Sierran alpine flora, showing 3.8% of the species as truly "boreal," 14.2% Arctic-Alpine, and 82% "Alpine," decomposing into 64% cordilleran (7.3% Beringian, 17.3% Rocky Mountain species) and 17.9% "western," of which 7.3% are "widespread western" and 10.6% Great Basin. Nearly a sixth of the flora is endemic, and another sixth occurs in the Sierran-Cascade axis only.

The distinctness of the Sierran alpine flora is thus amply documented, but its derivation remains controversial despite an abundance of speculation.

The Sierran Alpine Butterfly Fauna

Now we may return to the Sierran alpine butterfly fauna and examine its characteristics. Only three species are "good" Sierran endemics: *Oeneis ivallda*, *Colias behrii*, and *Hesperia miriamae* (also in the White Mountains). All of these belong to circumboreal genera, and their interpretations all present serious biosystematic problems. *Hesperia miriamae* seems most closely related to *H. nevada* (MacNeill, 1964), which is disjunctly distributed in the Rockies, the high Sierra, the Charleston Mountains of southern Nevada, the Warner Mountains, various parts of the Oregon and Washington Cascades and the Wallawas, Vancouver Island and southern British Columbia. The populations east and west of the Great Basin are phenotypically differentiated. Here, then, we appear to have a locally derived endemic from a northern source. *Oe. ivallda* is closely allied to *Oe. chryxus*, the most widely distributed member of the genus in North America. Its precise relationship with what has been called *Oe. c. stanislaus* remains uncertain. Hovanitz (1940) and Garth and Tilden (1963) regarded them as conspecific, while Emmel (in Howe, 1975) did not. The range of *stanislaus* (Carson Pass to Echo Pass)

is completely contained within that of *ivallda*, which reaches north to Donner Pass. We will sidestep this problem by lumping them under *ivallda*; if they are distinct this would cause us to underestimate the degree of Sierran endemism. *Colias behrii* is a member of the *Vaccinium*-feeding complex and is a derivative of *C. palaeno*, *pelidne*, or *interior*. The nearest extant populations of these are: *palaeno*: northern British Columbia; *pelidne*: eastern B.C., Montana, Idaho, and NE and WC Wyoming; *interior*: Canadian Zone in Washington and Oregon. Despite the contiguity of *interior*, our impression is that *behrii* is closest to *palaeno*. This problem can be addressed by a phylogenetic analysis of the group, including the early stages, wing pigments, and any other useful data.

At the subspecies level, the Sierran alpine fauna contains the obvious circumboreal relict *Lycaena phlaeas hypophlaeas*, disjunct from the High Sierra to the Wallows in northeastern Oregon; *Chlosyne damoetas malcolmi* of the central and southern Sierra, only weakly distinguished from nominate *damoetas* in Wyoming, Colorado, B. C. and northeastern Utah; and several subspecies of *Euphydryas editha* and *chalcona* whose affinities are obscure within these immensely complicated groups. *Plebeius shasta* is moderately differentiated in the High Sierra (*comstocki*) but occurs in typical form in eastern Oregon, Washington, and Idaho and in Nevada.

Lycaena editha and *L. cupreus* are subalpine or alpine species at the latitude of Yosemite (Garth and Tilden, 1963) but both are montane at Donner Pass and northward (Emmel and Emmel, 1962; Shapiro, unpublished). Both extend to the north and northeast of California. *L. cupreus* has to have come from the north, since the Rocky Mountain populations at this latitude are the quite distinct subspecies *snowi*, a high-alpine resident that far south but descending to moderate elevations in Wyoming. Its range as a species reaches southeastern Alaska and there are closely related species in central Asia. *L. editha* belongs to a strictly Nearctic group of considerable antiquity, as shown by the disjunction between the ranges of *L. xanthoides* on the Pacific slope and *L. dione* in the midwest. The present distribution of *editha* supports a northern route. *Agriades "glandon"* or "*aquilo*" belongs to another circumboreal complex whose taxonomy is, as usual, muddled. The Sierran entity, *podarce*, has been interpreted as extending north into Oregon while the more boreal entity *megalos* extends south into Washington. The distinct subspecies *rustica* is in the central and southern Rockies, south to New Mexico; it differs from the more westerly ones in habitat as well as facies. F. Michel (*pers. comm.*) claims to have found *rustica* and *podarce* parapatric in different habitats in Utah, suggesting that our assemblage includes at least two species. Again, phylogenetic analysis is needed, but there is no reason to doubt a northern dispersal route for this complex into California.

In summary, the Sierran alpine fauna includes: one circumboreal relict (*L. phlaeas*) clearly derived from the north; an endemic (*C. behrii*) whose most probable ancestor (*C. palaeno*) is far to the north; several species whose distributions are not inconsistent with dispersal from either the north or the east, but are less conjectural with a northern route (*Oe. ivallda*, *P. shasta*, *L. cupreus*, *L. editha*, *A. glandon*, *C. damoetas*); one endemic (*H. miriamae*) apparently derived from a species (*H. nevada*) which colonized the Sierra from the north; and several obscure *Euphydryas*. Some additional components of the high-altitude Sierran fauna are discussed in the next section.

The interpretation of this fauna could potentially be modified by discoveries in the Trinity - Eddy Region. We have already seen that plant relicts and disjunctions between this area and the High Sierra are not uncommon. Axelrod (1976) says: "Spreading montane Mediterranean climate not only restricted many taxa in the Sierra during the later Quaternary, and eliminated others, but it probably accounts for the present restricted range of the Rocky Mountain - Cascade conifers in the Klamath - Siskiyou region. As compared with the Klamath - Siskiyou region, the lower forest diversity in the Sierra, which results chiefly from the higher summer evaporation rate there, seems attributable to spreading montane Mediterranean climate. So far as woody plants are concerned, the Klamath - Siskiyou region is basically a reservoir into which have poured taxa from diverse sources, which have persisted there in favorable sites under a climate more like that of the late Quaternary than elsewhere in the Far West." It would thus not be unreasonable to expect important butterfly relicts there, too.

Comparisons Among Faunas

Let us first consider the overall faunal similarities. In table 1 the combined faunas of the Trinity Alps and Mount Eddy are compared with comprehensive faunas, both published and unpublished, for one area to the north (Crater Lake National Park, Oregon) and several to the south. These comparisons must be qualified. First, a subjective decision was made as to the distinctness of subspecies, and those which we judged to be clinal or ambiguous were not listed separately. This has the potential to cause an underestimate of endemism, or an overestimate of similarity. Second, the areas represented by these faunas differ, but species - area relationships cannot be precisely determined. Within each area sampling was done only in selected sites - selected for habitat types, "representativeness," and accessibility - and only subjective estimates of the adequacy of coverage of the larger area can be made. Nonetheless, granted the much larger area of the Sierra Nevada, the Trinity - Eddy fauna (116 species and subspecies) is clearly rich; Yosemite National Park, covering the entire set of altitudinal zones on both slopes of the Sierra, has 148 and the South Yuba River country, covering the same set of zones as the Trinities but including Donner Pass (102, for its size one of the richest faunas in temperate North America), has 124. Table 2 shows the similarities among the faunas using three commonly used, simple indices of faunal resemblance - Jaccard's (1902) coefficient of community, Simpson's (1943) index, and Sorensen's (1948), both more useful if the sizes of the faunas differ markedly. Using all three, the Trinity - Eddy fauna is more similar to Crater Lake than to any of the Sierran ones. At the subspecies level, 71 of 80 entities at Crater Lake also occur in the Trinity-Eddy fauna; at the species level the resemblance is even greater. In the Sierra the closest affinities are to the Lang Crossing (mid-elevation) and Yuba Pass faunas, both in the north. This reflects not only geographical proximity but the preponderance of montane taxa in the Trinity-Eddy fauna, and the relatively low level of endemism in the montane fauna. We proceed to consider only the subalpine and alpine faunas in tables 3 and 4; here the level of differentiation is higher.

We have separated the Trinity and Eddy high-elevation faunas and compared them to each other and to the subalpine-alpine faunas of Donner Pass + Castle Peak and Yosemite. As expected, the Trinities and Mount Eddy resemble each other much more strongly than either resembles the Sierra, but Mount Eddy resembles Donner + Castle more strongly on all indices than any other between-

region comparison. This probably reflects continentality of climate rather than a historical connection - there are no relicts to suggest that Mount Eddy was a stepping-stone between the ranges, and only the intermediate population of *Satyrium fuliginosum* to suggest genetic connections across it.

We found no "Sierran" endemics in the Trinity - Eddy region at all. All of the High Sierran endemics - *Oe. ivallda*, *C. d. malcolmi*, *C. behrii*, *H. miriamae* - are absent; so is *L. phlaeas*, which jumps to the Wallawas; so is *Plebeius shasta*, which goes up the east side of the Sierra north of Castle Peak through Plumas and Lassen Counties, and occurs in the Warners; and so, strikingly, are *L. cupreus* and *L. editha*. The northern range of *cupreus* is poorly understood north of Plumas County, but *editha* occurs in southern Siskiyou County (Bartle - McCloud - Hambone area); both it and *cupreus* extend northwestward to Crater Lake (Tilden and Huntzinger, 1977). *L. editha* actually occurs as close to our study area as Dunsmuir, Castle Lake, and Mount Shasta City.

Several species occur in the Trinity-Eddy and Sierran high country, but the subspecies are different: *Speyeria egleis*, *S. mormonia*, *Euphydryas editha*, *Satyrium fuliginosum*, *Parnassius phoebus*, *Thorybes mexicana*, *Hesperia harpalus*, and *Polites sabuleti*. The most spectacular of these is *S. mormonia*. We were amazed to find *S. m. erinna*, the eastern Cascade - Wallawa subspecies of Oregon, at Deadfall Lakes - a range extension of 120 km. Sierran *S. m. arge* reaches its northward limit near Yuba Pass. The Trinity-Eddy subspecies of all the complexes listed above extend north into Oregon, except perhaps *S. fuliginosum* (whose range may be coterminous with that of its endemic host, *Lupinus croceus*). *Polites sabuleti* is especially intriguing because it occurs as an isolated relict population at Plaskett Meadows, Glenn County, along with *Parnassius clodius*, 120 km SSW of its Trinity range. This is an extremely isolated boggy meadow; the occurrence of disjunct species there implies northward retreat from a formerly more extensive range (Hemphill, 1971). *Agriades glandon* is sufficiently different in the Trinity-Eddy region to be nameable as a weak subspecies distinct from *podarce*. The females of *Lycaena heteronea* are exceptionally variable, the underside markings tend toward ssp. *gravenotata*, and the Trinity-Eddy phenotypes extend to the Yolla Bollys (S.O. Mattoon, pers. comm.) and to the isolated relict populations in the Coast Range south to Marin County. Two very widespread high-altitude species, *Callophrys lemberti* and *Pieris occidentalis*, show subtle differences between the Trinity-Eddy and Sierran phenotypes, the latter as part of a long cline starting in arctic Alaska.

At least three montane species (*Lycaena arota*, *Habrodais grunus*, and *Cercyonis silvestris*) appear to have clines across the study area, associated with the moisture gradient. We have no basis to discriminate between primary and secondary intergradation in these cases. All the species are somewhat colonial. At higher elevations three species - *S. fuliginosum*, *S. egleis*, and *T. mexicana* - also seem to be clinal. *Fuliginosum* has already been mentioned. *S. egleis oweni* is most distinct to the east, on Mount Eddy and Mount Shasta, while Trinity specimens tend to look more like *S. e. egleis* of the Sierra. At present we cannot discriminate between parallelism and a historical connection providing a source of *egleis* genes. In *T. mexicana*, Mount Eddy specimens are more typical *aemilia* than Trinity ones - which depart even further from the Sierran *nevada* phenotype.

No one seems to doubt that *Pinus balfouriana* entered the Sierra from the north. It is a very long-lived tree - over a millennium - but the Sierran and Klamath

populations are phenotypically and physiologically different (Mastrogiuseppe, 1972 and D. Axelrod, *pers. comm.*). The degree of differentiation observed between Trinity-Eddy and Sierran conspecifics should not be surprising given the much more rapid turnover of butterfly generations. However, this differentiation is equally compatible with northern and eastern origins for the Sierran fauna. How significant, then, are the absences of Sierran endemics from the Trinity-Eddy area as an argument for double colonization of California?

Types of Absences

There are two sets of hypotheses to account for the absence of a species from a given area:

1. It never occupied the area at all. (It was unable to reach it due to physiographic or climatic barriers, or sheer distance; or it had access to it but was excluded by either abiotic or biotic factors, such as climate and competitors.)

2. It was formerly present but became extinct. (Either abiotic or biotic factors could be responsible; or if the area occupied was small, extinction could occur purely by chance.)

Were the Trinities too remote from potential source regions to be colonized by the Sierran fauna? If colonization was from the north this seems very unlikely, since to reach the Sierra the species would have had to pass down the Cascades immediately to the east. The relatively low country and the long distances between the Trinity-Eddy area and Yuba Pass could, however, easily have hindered or prevented *northward* colonization by a fauna invading via the Great Basin, as suggested by Major and Bamberg. There are no potential competitors to exclude the Sierran endemics were they to be introduced today.

The extent of subalpine and alpine habitat in the Trinities is small, but it must have been greater when climatic snowline was depressed some 300 m. If the alpine were there at that time they would have retreated upslope and perhaps become extinct as suitable habitats became limitingly small. However, it is striking that so large a segment of the Sierran alpine fauna persists at its northern limit, on the small, isolated alpine area of Castle Peak (Shapiro, 1977). The extinctions, if extinctions there were, would probably have involved the climatic differences between the Klamath and Sierran alpine zones.

What limits those "Sierran" species which have access to the Trinity-Eddy area today, but fail to colonize it? *Lycaena editha* gets within 12 km of Mount Eddy. Emmel and Emmel saw it oviposit at the widespread weed *Rumex acetosella* at Donner Pass in 1971. This plant is common in the Trinity-Eddy area. It is, however, a fairly recent introduction in the California flora, and *L. editha* must have had a pre-European host. In the Sierra we have found it using *Polygonum phytolaccaefolium*, a common montane - subalpine species which ranges north to subarctic Alaska; it occurs at both Mount Shasta City and Bartle but has never been found in the Trinities or on Mount Eddy, even though it goes around them to the north into the Siskiyou (Major and Taylor, 1977, p. 621-23; Sawyer and Thornburgh, 1977, p. 708). It *could* be a limiting factor on the westward spread of *L. editha* in the Trinities, but this merely pushes the question back one level - why is *P. phytolaccaefolium* absent? The weed *R. acetosella* is also a host plant of *L. cupreus*, which has a similar distribution but has not been noted as associated with *P. phytolaccaefolium*. Chabot and Billings (1972) investigated the Sierran alpine flora from a physiological

standpoint, and physiological adaptation to climate is probably just as important in butterflies, though more difficult to study. It is plain, for example, that the large populations of *Colias philodice eriphyle* and *Lycaeides melissa* in Scott Valley have access to the Central Valley of California, with its extensive alfalfa plantations, through the lowlands along Highway 3; but they make only very feeble penetrations beyond Callahan, presumably for physiological reasons.

The same climatic characteristics which make the Klamath Province a reservoir for relict plants could be inimical to the butterfly fauna: increased cloudiness and precipitation, including that during the growing season. The butterfly faunas of the rainy western slopes of the Pacific Northwest, from northern California to the Alaska Panhandle, are notoriously depauperate despite high floristic diversity and endemism. Even if present climates were not limiting, the Pleistocene Klamath Province could have been intolerably wet and cloudy for butterflies, so that the invaders from the north passed along the Cascade - Sierran axis and failed to enter the Trinities at all. (The Trinity fauna includes several Arcto-Tertiary species at montane levels - *Pieris napi*, *Habrodais grunus*, *Celastrina argiolus* - which may have reinvaded from the Coast Range after being driven out by severe Pleistocene climate. This is consistent with the variation of *H. grunus* and especially with the geography of *P. napi* subspecies in the region; Shapiro, unpublished).

A number of prominent circumboreal butterfly groups or species of the central Rockies are totally absent from California (indeed, on the Pacific slope south of Washington): *Pyrgus centaureae*, several *Colias* and *Oeneis*, the genus *Erebia*, and *Euphydryas gillettii*. At present it is impossible to determine whether any of these could plausibly have entered California and become extinct: the general east-to-west diminution in the boreal butterfly fauna of the west has the same two sets of explanations as the absence of the Sierran endemics from the Trinity-Eddy region.

The Trinity-Eddy and Sierran butterfly faunas are more differentiated from each other than the avifaunas. From Miller's (1951) table 7 we find 49 bird species in common, out of totals of 57 (Trinity) and 72 (Sierra). These give Jaccard and Simpson coefficients of 61.25% and 85.97% respectively (the highest Trinity-Sierra values are with Lang Crossing, 55.88% and 79.17%). Most of the difference in the avifaunas is due to the "non-boreal" components (10/57 Trinity vs. 18/72 Sierra); only two shared species are "non-boreal."

Butterfly Biogeography: Conclusions

The Quaternary biogeography of the Far West is in far from a satisfactory state, even though more complete scenarios of past floristic changes exist there than elsewhere in the Nearctic. Frustrated butterfly biogeographers may note the ongoing controversies among paleobotanists, who have extensive fossil and subfossil evidence, and be heartened that in the absence of fossil evidence they are able to develop scenarios at all. It is now plain that the relictualism of the Klamath flora is not matched in the butterflies, and we must integrate this fact with the floristic scenarios in an acceptable way.

The proportion of "Rocky Mountain" butterfly taxa *increases*, not *decreases*, southward in the Sierra Nevada. The Sierran high-altitude fauna is mostly not derived from regional lowland sources, unlike the flora; it is the result of long-range dispersal and subsequent differentiation. There are two "Rocky Mountain" relicts in the north state to challenge our set of generalizations - *Polites themistocles* and

Euphyes vestris - but both are in the Bartle area of Siskiyou County, not in the Klamath Province, and both are montane, not subalpine or alpine. (This area is also notable for the relict occurrence of the northern Dolly Varden Trout, *Salvelinus malma*.) In California *vestris* is a very remarkable relict, occurring in the coastal fog belt in Santa Cruz, Sonoma and Mendocino Counties, and again in seep habitats in San Diego County and Baja California Norte; Emmel and Emmel (1973) state that the northern and southern populations are phenotypically different. *P. themistocles* seems to be known from only the one station at this time. Neither seems to be of any use in interpreting Trinity-Sierran patterns.

Forthcoming books on the butterflies of the Rocky Mountain region and the Pacific Northwest will provide vital data to assess the distributions of California taxa in a regional context. Based on what is available now, we are forced to the following conclusions:

1. The high altitude (subalpine and alpine) butterfly faunas of the Trinity - Eddy region and the Sierra Nevada are strongly differentiated - definitely more so than the respective avifaunas and perhaps more so than the floras.

2. Where a species is differentiated into subspecies in the Klamath and Sierran faunas, the former extends into Oregon while the latter is a Sierran endemic, mostly occurring in the high country south of Yuba Pass.

3. The butterflies are not dependent on plant taxa for which paleobotanical data are available, and with a very few exceptions are not associated with plants whose distributions are relictual or endemic.

4. There are no distributional phenomena in the butterflies which are absolutely incompatible with Major and Bamberg's hypothesis. The bulk of positive evidence (living relicts) favors a generalized northern route into the Sierra, with subsequent (Xerothermal?) extinctions of many taxa in the lower northern part. The negative evidence (complete absence of alpine or subalpine relicts in the Trinity - Eddy fauna) is more consistent with the eastern route, but there are several potential explanations available.

5. In view of the broader problems posed by Major and Bamberg's hypothesis we tend, somewhat reluctantly and provisionally, to agree with Axelrod (1976, 1977) and Raven and Axelrod (1978) that the northern route is more likely. We are unable to determine if the absence of "Sierran" butterflies in the Klamath Province is primary or secondary.

We note, finally, that no one has yet examined the trans-Beringian butterfly faunal connections in a systematic manner. Several groups with largely subalpine or alpine distributions in western North America (*Pieris occidentalis*, Shapiro, 1980; *Lycæna cupreus*; *Neominois ridingsii*) show clear affinities with Central Asian taxa and indications of past circumboreal distribution in cold steppe or periglacial steppe-tundra like that envisioned for the Great Basin by Major and Bamberg. These connections should become more apparent as the Central Asian fauna and literature become better known to American workers and as the Alaska Lepidoptera Survey continues to document the extent of present trans-Beringian interchange.

Zonal Relationships and Altitudinal Anomalies

The Nearctic butterfly literature has been strongly influenced by Merriam's (1898) "life zone" concept, which pervades much of western natural history. It was applied consistently by Garth and Tilden (1963) in their treatment of Yosemite

butterflies, although they were obliged to express the west-east slope dichotomy in terms of Dice's (1943) biotic provinces, and Merriam's zones tend to break down on the Great Basin side. Even in Yosemite, Garth and Tilden were obliged to acknowledge (p. 77) the existence of "anomalous situations" - "While the regularity of zonal progression and the exclusiveness of biotic provinces have been emphasized, certain irregularities occur that are of sufficient interest to the Lepidopterist to warrant consideration." There has been a general movement in American plant ecology for some 25 years away from classificatory schemes and toward an "individualistic" approach to species distributions (see Gleason, 1939): a benchmark paper in this direction was Whittaker's analysis of Siskiyou Mountains vegetation (Whittaker, 1960). Life zones are a useful pedagogic device, but their correspondence to coevolved, repeating ecological units is questionable. Paleobotanical evidence (Axelrod, 1977; Raven and Axelrod, 1978) is unequivocal in showing that communities or associations have formed, fragmented, and reformed in novel combinations throughout the geologically and climatologically unstable Quaternary. The present life zones can be seen in this context as merely transient assemblages of species whose physiology and distributional history permit them to co-occur in the climates that exist at the moment.

Although there are broad similarities between Sierran and Trinity-Eddy vegetation, translation of Garth and Tilden's life-zone analysis of the Yosemite butterflies to the Trinity fauna is almost impossible. The problems are the same as described vividly by Hemphill (1971) for the Yolla Bolly vegetation: "The Yolla Bolly Range is so abrupt and narrow that zonal conditions are telescoped together. To the east lie the heated foothills, and on the west the mountainside is swept by cool winds....In the vicinity of Black Butte, Upper Sonoran and Canadian conditions lie within three miles of one another. This tends to produce a greater mixture of floral and faunal elements than one finds in the broad, gradual slopes of the Sierras....Any attempt to separate the Transition and Canadian elements in the life of this region does violence to the natural grouping, as most species occur throughout the extent of the coniferous forest belt....a large number of associations are involved in a complex mixture of bewildering confusion....The mixed forest area offers one of the most difficult problems to the ecologist who tries to interpret field conditions in terms of Merriam's life zones....the mapping of the life zone distribution cannot but be inaccurate."

A number of butterflies occur at higher elevations in the Trinity - Eddy region than they or their close relatives do in the Sierra, despite the fact that the range is farther north and that many plant communities extend lower. These include *Cercyonis silvestris* (to 2100 m), *C. pegala boopis* (1545 m), *Coenonympha tullia eryngii* (2200 m), *Habrodais grunus* (2000 m), *Satyrium californica* (2275 m), *Pieris napi* (2100 m), *Hesperia columbica* (1600 m), *Thorybes pylades* (1430 m), and *Epargyreus clarus* (1400 m). (Weedy species like *Plebeius acmon* and *Colias eurytheme* occur more consistently at high elevations in the Trinities because of the short dispersal distance from the lowlands, but they do not overwinter.) Other species follow their plant communities to lower elevations than in the Sierra: *Chlosyne hoffmanni* (to 1400 m), *Agriades glandon* (1500 m), *Pieris occidentalis* (850 m in Scott Valley), *Parnassius phoebus* (2040 m), and *Thorybes mexicana* (1430 m). The usefulness of butterflies as "zonal indicators" is questionable when some species show the zones moving upslope, others down.

Several special cases deserve individual mention.

Phyciodes campestris. - The distinctive Sierran entity *montana* does not seem to occur north of Yuba Pass. Already in Plumas County and through the Lassen, Bartle, Eddy and Trinity regions it is replaced in similar habitats - montane to subalpine meadows - by nominate *campestris*, which extends thence north to Alaska with almost no phenotypic change. *Campestris* from near Bartle are rather aberrant, but Trinity-Eddy material grades insensibly into coastal low-altitude *campestris*, which in turn grades into the spring phenotype of Central Valley *campestris* (although the summer phenotype is distinctive). We do not understand the restriction of *campestris* to the valley floor and lower foothills and its complete replacement from 1450 m upslope by *montana* (after a band some 1000 m wide in which neither occurs). We have taken female *campestris* several times between 1000 and 1500 m on the west slope and therefore assume that colonization is possible. Shapiro (1975) thought that the proportion of fully-patterned *montana* was higher at 1500 than at 2100 m, suggesting gene flow, but statistical analysis of very long series has revealed no difference in males and a significantly lower incidence of dark females at 1500 m (Shapiro, unpublished). The genetic relationships among the various entities in this complex badly need to be determined.

The genus *Thorybes*. - We have taken *T. pylades* and *T. m. aemilia* together at Morris Meadow and *T. m. aemilia* and *T. diversus* together at Mumford Meadow. In the Sierra Nevada these three species are "stacked" altitudinally and segregated by habitat: *T. pylades* in foothill riparian, *T. diversus* in small openings in mid-elevation montane coniferous forest, and *T. m. nevada* in high-montane to subalpine meadows. The "telescoping" referred to by Hemphill is evident here.

Anthocharis sara. - In both the Sierra and the Coast Ranges nominate *sara* occurs in foothill (mostly riparian canyon) and lower montane habitats to about 1500 m. In the higher montane and subalpine environments and on the east slope of the Sierra occurs the yellow "subspecies," *stella*. The relationship between these two is unclear. Yellow females (but not males) occur rarely in Coast Range and Sierra foothill populations. The two forms do not seem to intergrade at mid-elevations, but they do occur sympatrically or at least parapatrically; no one has reported crossing them in the laboratory. *Stella* is one more Sierran element absent from the Trinity-Eddy region presumably for historical reasons, even though seemingly suitable habitats are available. Nominate *sara* does not move up into these habitats to replace it. In this case zonal adaptation is unexpectedly strong at the "subspecies" level.

Altitudinal "Ecotypes." - In the genera *Everes*, *Lycaeides*, and *Apodemia*, and possibly others as described below, species occur disjunctly in different habitats at different elevations within the Trinity-Eddy region. *Everes amyntula* has at least three different hosts which occur in widely differing habitats - from streamsides in lower montane coniferous forest to the bleak, windswept alpine wastes atop Mount Eddy. There is an alpine *amyntula* on Castle Peak as well, using the same host plant (*Asiragalus whitneyi*) (Shapiro, 1977). A quantitative comparison of spot-patterns for series of over 60 each of the two alpine populations shows significant differences between them, as also between each and its nearest montane population. We have been unable to partition the variation between environmental and genetic factors as yet (Shapiro, unpublished). Our series of alpine Trinity-Eddy *Lycaeides argyrognomon* is too small for statistical treatment, but there is a suggestion of

phenotypic differences from montane ones. There is a definite phenological difference between the subalpine-alpine *Astragalus* feeders and the bog-meadow *Lotus* ones, and the situation is complicated by the fact that the region lies in the blend zone between the Sierran and Oregonian subspecies, *anna* and *ricei*. In the central Sierra (Carson, Sonora Passes) occur alpine *Lycaeides* on *A. whitneyi* which are phenotypically very close to *L. melissa inyoensis* but which are said to be genitically members of the *argyrognomon* complex (P. Opler, pers. comm.). They do not at all resemble the montane *anna* 1000 m lower, although their ecological relationship is precisely analogous to the Trinity situation. We have determined that the *melissa*-type animal which co-occurs with *argyrognomon* on Packer's Peak and Gumboot Butte is *melissa melissa* and not distinguishable from the multivoltine, weedy *melissa* in Scott Valley, but the genetic relationship between these two is unknown.

Apodemia mormo has phenotypically indistinguishable populations on two widely different *Eriogonums* in the foothill canyons and the subalpine ultrabasic Red Trinities. The latter occur as high as any in the Sierra Nevada, where subalpine *mormo* are confined to the east slope. *Satyrium californica*, *syllivus* and *saepium* all occur high in the Trinities and presumably have different hosts at different elevations. All are reported higher in the Trinity-Eddy region than in Yosemite, but all three occur at 2100 m at Donner Pass.

Euchloe ausonides is poorly understood in montane California. In both the Trinity-Eddy region and the Sierra Nevada there are high-altitude populations which are phenotypically different from lower ones, and closer to the Rocky Mountain *coloradensis*. None of these have been hybridized. Strikingly, in the European *ausonia* the same altitudinal "subspeciation" occurs, with the entities parapatric (Higgins and Riley, 1970, p. 51 and map 23).

Atalopedes campestris. - This is usually considered an "Upper Sonoran" butterfly, resident in the hot Central Valley and lower foothills. It has bred sporadically as high as 1500 m on the Sierran west slope, and turns up as a rare stray at 2100 m (Shapiro, unpublished). MacNeill (in Howe, 1975) describes its range as "Atlantic to the Pacific in the southern half of the United States." We were quite surprised to find it in a small collection made by S. K. Peoples in Scott Valley in September 1977. In September 1979 we took it in large numbers on Rabbitbrush at Callahan and French Creek. It is a strange animal to find side-by-side with *Pieris occidentalis* and *Speyeria cronis simaetha*, once again illustrating that zonal classifications tend to break down in the arid Great Basin influence.

Competitive Interactions

Many ecologists view communities as structured by competition in both ecological and evolutionary time. In ecological time interspecific competition may exclude species from part or all of the contested resources, and hence the range (Hardin, 1960). In evolutionary time it is theorized to act by "character displacement" (Brown and Wilson, 1956) - a hypothetical process of increasing divergence of ecological requirements through time, lessening competition and permitting coexistence (and thereby packing species densely onto resources). "Character release" is the term given to the broadening of a species' resource utilization which is alleged to occur in the absence of competitors. The two phenomena are conceptually distinct but in practice may be indistinguishable if historical inferences about dispersal and sympatry cannot be made. Character displacement has become a central dogma of

ecological theory (Diamond, 1978) but is not without its critics (Birch and Ehrlich, 1967; Grant, 1972; Wiens, 1977; Shapiro, 1978a). Its applicability to phytophagous insects is unclear, because their populations may be regulated by other factors before competition becomes limiting (Hairston, Smith and Slobodkin, 1960; Ehrlich and Birch, 1967). The pitfalls of applying the model in a facile way to apparent "resource partitioning" were noted by Shapiro and Carde (1970) and Carde, Shapiro, and Clench (1970).

Faunal differences like those between the Sierra Nevada and Trinity-Eddy region provide potential opportunities to test these ideas. In particular, the altitudinal compression of *Thorybes* species and *Phyciodes campestris* - *montana* situation seem interesting. In order to apply the character displacement model it is necessary, but not sufficient, to establish the identity of the resources for which the organisms compete. Habitat selection can be the evolutionary consequence of physiological limitations rather than competition, but the physiological limitations themselves might be a secondary consequence of competition. If *Anthocharis sara stella* was never in the Trinities, the failure of *A. s. sara* to expand into its habitat cannot be due to character displacement *in situ*. It could be the consequence of previous character displacement if Trinity *sara* are derived from the Sierra and are physiologically and behaviorally conservative, but there is absolutely no reason to believe this.

Another problem is the uneven distribution of phytophagous insects over potential host plants (Ehrlich and Raven 1965, Southwood 1961). The usual explanation of this is coevolutionary, based on secondary plant chemistry, but "architectural" hypotheses are now appearing (Lawton, 1978). In both the Sierra Nevada and Trinity-Eddy regions certain plants seem overloaded. The genus *Eriogonum*, used by so many Lycaenidae, is one; the legume *Astragalus whitneyi* is another. This has three blues each in two alpine faunas (*E. amyntula*, *L. melissa*, *L. argrognomon* in the Trinities; *E. amyntula*, *P. shasta*, *L. "melissa"* in the Sierra - we have not found all 3 together) while sympatric *Astragalus* are apparently ignored. The origin and organization of such densely-packed faunas should be of great interest.

The phenomena we have been discussing all disappear readily when distributions are interpreted zonally and species are treated as interchangeable. Miller (1951) addresses the problem sagaciously: "Efforts to develop broad distributional principles and categories commonly run beyond the facts and violate the essentially statistical character of distributional data. There is an urge to create simplified concepts, perhaps unwittingly as paths of least intellectual resistance. These may become lines of escape from exhaustive factual comprehension....(an) account of affairs, species by species, with its data on the habitat and distributional limits of each, may be a more substantial scientific record than (a) generalized review..."

Phenology

One of us (AMS) has carried out detailed phenological studies along an altitudinal transect parallel to Interstate Highway 80 since 1972. The data thus obtained are not strictly comparable with our Trinity-Eddy data because the former were taken by repeated intensive sampling at fixed study sites, while the latter are extensive and sporadic. We do not have enough replicates for any single Trinity site to construct a reliable seasonal species curve for it. Instead we have pooled data for the range as a whole (table 5). These are based on 1976, the year of our most wide-

ranging surveys. We will defer detailed comparisons with the Sierran faunas until a later publication, but wish to comment on one unusual aspect of Trinity-Eddy butterfly phenology - the autumn "boom."

In the Mediterranean climates of California the great bulk of univoltine species occur early in the season, when soil moisture is still high for plant growth. Throughout temperate North America there is an apparent shortage of autumnal univoltines (Shapiro, 1975a). At Donner Pass in the northern Sierra there are three in a fauna of 102 species: *Apodemia mormo*, *Ochlodes sylvanoides*, and *Neophasia menapia*. All of these fly in September; Emmel and Emmel (1962), who stopped collecting in mid-August, missed the first two altogether. Despite this small number of univoltine species, the total number of butterflies flying at Donner in September and into early October is high, including *Polygonia zephyrus*, *Vanessa annabella*, *virginiensis*, and *cardui*, *Speyeria mormonia arge*, *S. zerene*, *S. coronis snyderi*, *Satyrium saepium*, *Pieris occidentalis*, *Hesperia juba*, and the weedy multivoltines *Colias eurytheme*, *Precis coenia*, *Plebeius acmon*, etc. (Shapiro, 1978b). Many of these same species can be collected in the Great Basin at similar seasons. In the high country and on the east side there is only one major nectar source this late in the year: Rabbitbrush, *Chrysothamnus nauseosus*. Apart from its many butterfly visitors, it has a large pollinator fauna including at least a dozen diurnal moths (mostly Noctuidae with showy, banded hindwings), Tachinid flies, and Hymenoptera. Some of these are oligolectic.

Many species emerge later in the Trinity-Eddy region than in the Sierra at similar altitudes. The autumn-univoltine fauna includes not only *A. mormo*, *O. sylvanoides*, and *N. menapia*, but *L. heteronea*, *L. arota*, *C. pegala boopis* (at its highest elevations), and *P. sabuleti* as well. The total butterfly biomass appears to be greatest in late September, and the best general collecting in the region, including Scott Valley, is at this time (42 species on 21 IX 79; compare 31 at Donner Pass, 10 IX and 11, 30 IX 79). The autumn "boom" includes multivoltine species like *Coenonympha tullia eryngii*, *Pieris occidentalis*, *Lycaena helloides*, *Lycaeides melissia*, and *Colias philodice*; females of *Speyeria zerene* and *coronis* which have emerged from adult diapause; and immense numbers of branded skippers, including *H. juba*, *harpalus*, and *columbia*, *A. campestris*, and *P. sabuleti* (which in the Trinity Alps may outnumber all other butterflies together). This autumn fauna is a Rabbitbrush fauna (along with the very similar *Haplopappus bloomeri* on ultrabasics). Without these yellow Composites it is difficult to envision the persistence of this phenology.

The most striking phenological anomaly in the Trinities is *Polites sabuleti*. The unnamed "Trinity" *sabuleti* is strictly an autumn univoltine, flying in September and early October at 1500-2000 m. In the Sierra Nevada, *P. s. tecumseh* extends from around 1400 m to above tree line; it is univoltine, with a rudimentary second brood some years in autumn at its lower limit. The flight season is progressively later with increasing elevation, so that it flies in June at 1500 m, mostly July at 2100 m, and late August and September at 3200 m plus. Thus "Trinity" *sabuleti* fly more than two months later than Sierran *tecumseh* at the same elevation, but at the same time as Sierran *tecumseh* 1700 m higher! They may be reared without diapause in the laboratory, and keep their distinctive phenotype (Shapiro, unpublished - compare Shapiro, 1975b).

We do not have appropriate climatological data to be able to say whether the unusual phenology of Trinity butterflies is due to evolved "life-history strategies"

(i.e., patterns which maximize Darwinian fitness) or simply to slower degree-day accumulation working on similar physiologies. We have, however, found the coincidence of flight periods on the eastern slopes of the Sierra and in the north with the flowering time of *Chrysothamnus* to be very suggestive. *Chrysothamnus* is generally absent on the Sierran west slope, and *Haplopappus* species mostly bloom earlier; here there is little autumnal fauna except as spills over the passes. At Lang Crossing (1500 m) *N. menapia* and *A. mormo* emerge at least a month earlier than at Donner. *O. sylvanoides* flies mainly in September and virtually monopolizes *Aster*. It is by far the commonest autumn butterfly at Lang, occupying the same numerical position as *P. sabuleti* does in the Trinities (where *sylvanoides* is much less common).

Cases of potential seasonal displacements among closely-related species are rare in the Trinity-Eddy fauna. *Speyeria callippe rupestris* flies in June to mid-July; sympatric *S. atlantis*, *zerene*, and *hydaspes* fly together mostly from July to September. *S. callippe* is also the earliest *Speyeria* on the Sierran west slope, and the one to reach the lowest elevations. It has a high larval desiccation tolerance and passes the summer as a very young larva, unlike *S. zerene* and *coronis* whose larvae are less drought-resistant, and which estivate as adults (S.R. Sims, pers. comm.). If this is a case of time partitioning, which is far from certain, it could reflect either competition for resources or reproductive isolation. *S. callippe* is also strikingly altitudinally allopatric with *S. egleis oweni*, a fact which may or may not be biologically significant.

Annotated List of Species

DANAIDAE

1. *Danaus plexippus* Linnaeus. Monarch.

Common throughout the Trinity-Eddy area in all open habitats, even above tree line. On 17 VI 76 a concentration of Monarchs was found around a grove of Black Cottonwoods at the upper end of Morris Meadow. Of three collected, two were worn (overwintered) males and the third was a fresh female, obviously of the spring generation. On 20 IX 79 dozens of migrating Monarchs were seen at Rabbitbrush in Scott Valley, along Interstate 5 and Highway 3. Larvae were common at 1820 m on Packer's Peak, 9 VII 77, where they had virtually defoliated the entire colony of the host plant. They are often common in Scott Valley and west to Cecilville.

HOST PLANTS: Asclepiadaceae: *Asclepias cordifolia* (Benth.) Jeps., Packer's Peak; *A. speciosa* Torr., roadsides, Callahan and Scott Valley, 29 V 77, 11 VII 77.

RECORDS: Lone Jack, 28 V 77; Cecilville, 29 V 77; lower Coffee Creek, 14 VI 80; Crawford Creek, 15 VI 80; Morris Meadow (3); 17 VI 76; Swift Creek, 25 VI 77, 1 X 76; Coffee Creek, 26 VI 77; Mt. Eddy, 6 VIII 78; Sunrise Creek, 5 IX 76; Deadfall Lakes, 20 IX 79. (28 V - 1 X)

SATYRIDAE

2. *Oeneis nevadensis* Felder and Felder. Nevada Arctic.

Common in montane coniferous forest at middle elevations. The Nevada Arctic has been found in numbers in odd years in some places and in even years in others, but thus far not in both at the same place. Adults are usually encountered sitting in sunlit spots in the forest, often on fallen logs across trails. Male-male chases are frequent but rarely long sustained. There is considerable minor variation

in color and pattern.

Univoltine, with a long flight season.

HOST PLANTS: Presumably grasses, but unrecorded.

RECORDS: Boulder Creek, 12 VI 76; lower Coffee Creek (near Ranger Station), 14 VI 80; 11 km E Callahan (4), 15 VI 80; Callahan, 15 VI 80; Scott Valley, 15 VI 80; Bridge Camp, 17 VI 76; Morris Meadow (2) 17 VI 76, 26 VI 76; Lone Jack (3) 18 VI 77; Little Salt Creek, 24 VI 76; Deer Creek (2) 27 VI 76; Deadfall Lakes, 6 VIII 78; Mount Eddy, 6 VIII 78; upper Caribou Lakes Trail, 10 VIII 76; Gumboot Lake, 11 VIII 76; Cecilville, Crawford Creek (S.O.M.) (12 VI - 11 VIII)

3. *Cercyonis sthenele silvestris* Edwards. Sylvan Satyr.

Frequent in montane chaparral, Oregon Oak woodland, and dry montane coniferous forest with an understory of Huckleberry Oak, Pine-Mat Manzanita, and grasses. Decidedly colonial. Local concentrations may be encountered along sunlit trails in late afternoon, but captures are infrequent since the Sylvan Satyr flies vertically up canyon walls or takes shelter in dense brush when alarmed. Univoltine, peaking late in the season.

Considerable variation is apparent in our series. Some specimens look like north Coast Range or southwestern Oregon ones, while others approach northern Sierran foothill material. Females seem always to have a light frosting of white scales on the ventral hindwing (less pronounced than in ssp. *paulus* Edwards). This character has not been seen on males. The Hobo Gulch specimens look like miniature *pegala*, much like those figured by Dornfeld (1980, pl. 10) from Corvallis, Oregon.

HOST PLANTS: Grasses suspected.

RECORDS: Morgan Meadows (5), 12 VII 79; Hobo Gulch (2), 18 VII 77; Deadfall Lakes (7) 6 VIII 78, (16) 16 IX 78; Packer's Peak (2), 15 VIII 77; Papoose Lake trail, 30 VIII 76; Martin Gulch fork, 30 VIII 76; Dorleska Mine to Big Flat (5), 7 IX 76; Swift Creek, 1 X 76. (12 VII - 1 X)

4. *Cercyonis pegala boopis* Behr. Ox-Eyed Satyr.

Discontinuously distributed in the Trinities and thus far unknown from Mount Eddy, the Deadfall Lakes area, or Scott Valley. The three populations studied are located along streams in lower montane coniferous forest in the foothills (mostly in Yellow Pine), flying July-August; at Morris Meadow, abundant, late July-August; and extremely localized in a hillside boggy seep draining into Parker Meadow on upper Swift Creek, abundant, September-October. The last is perhaps the highest-elevation population of *boopis* known.

Very dark, with no trace of the hoary scaling on the ventral hindwing which is so characteristic of material from Mt. Shasta City in our large Parker Meadow series; but it occurs in some males and most females at Morris Meadow.

HOST PLANTS: Probably grasses.

RECORDS: Morris Meadow, 14 VII 79, (16) 4 VIII 79; Rte. 3, milepost TR47.00, 1200 m, 7 VIII 76; Douglas City (2), 29 VIII 79; seeps draining into Parker Meadow (11) 5 IX 76, (8) 1 X 76.

5. *Coenonympha tullia* near *eryngii* Henry Edwards. Northern California Ringlet.

Common and widespread at low elevations, occurring in open, dry, often disturbed sites from the foothills through the Yellow Pine belt to about 1200 m,

rarely to 2100 m in the larger meadows. Especially numerous in and along the edges of Scott Valley. In the Trinities mostly single-brooded in spring, with just a few fresh emergents in fall; apparently fully double-brooded at both Deadfall Meadow and Scott Valley. We suspect that careful statistical analysis will reveal a transition from *C. t. californica* Westwood in the southern foothills to *C. t. eryngii* in the Eddies and Scott Valley.

In Scott Valley and near Callahan occur Great Basin - type sedge marshes apparently suitable for *C. t. ampelos* Edwards, but repeated searching has not turned it up. In fact, no two named entities in *Coenonympha* appear to be sympatric anywhere in northern California, although strays of both *californica* and *ampelos* have been found near Donner Pass.

HOST PLANTS: Not certainly known; associated with introduced, weedy *Bromus* spp. (Gramineae) on both sides of the range, but this could reflect habitat selection rather than host preference.

RECORDS: Coffee Creek (4), 27 V 77; Canyon Creek (8), 28 V 77; Lone Jack, 28 V 77; Cecilville (5), 29 V 77; Crawford Creek (2), 29 V 77, (3) 15 VI 80; Shadow Creek (2), 29 V 77; Scott Valley (11), 29 V 77; lower Coffee Creek, 14 VI 80; Eagle Creek, 14 VI 80; Callahan, 15 VI 80; Bridge Camp (2), 17 VI 76; Morris Meadow, 26 VI 76; 3.2 km W Gazelle (3), 5 VII 80; Scott Mountain summit (2), 11 VII 77; Douglas City (3), 29 VIII 79; Deadfall Meadow (7), 20 IX 79; French Creek (Scott Valley) (3), 21 IX 79; Callahan, 21 IX 79, 25 IX 77; Parker Meadow, 1 X 76 (27 V - 1 X)

NYMPHALIDAE

6. *Speyeria cybele leto* Behr. Leto Fritillary.

Recorded on the "east flank of Mount Eddy" by K. Hansen, *teste* S. O. Mattoon. Occasionally common near Mt. Shasta City. This species often turns up far from breeding habitat, so until a definite population is located within the study area its status will remain uncertain. July-September.

7. *Speyeria atlantis* near *dodgei* Gunder. Dodge's Fritillary.

This fritillary is common at mid-elevations in montane coniferous forest, often visiting Pennyroyal (*Monardella*) flowers or, late in the season, straying into more open sites where *Chrysothamnus* or *Haplopappus bloomeri* are available. Phenotypically these animals are somewhat intermediate between true *dodgei* of the Cascades and Sierran *irene* Boisduval. There is considerable individual variation. Females average much darker beneath, with much more silvering, than males. A freshly emerged female was taken on Mount Eddy as late as 20 IX 79.

HOST PLANTS: Emmel and Shields report oviposition on *Viola purpurea* Kell. at Brown's Meadow, 23 VII 68. We have seen ovipositions only after the *Viola* were dried beyond recognition.

RECORDS: Morris Meadow (2), 24 VI 76, (2) 25 VI 76, 26 VI 76, (3) 4 VIII 79; Deer Creek, 27 VI 76; Granite Creek (3), 30 VII 76; Gibson Meadows, 30 VII 76; Stuart Fork below Sawtooth Ridge (7), 5 VIII 79; Deadfall Lakes (2), 6 VIII 78, (2) 16 VIII 79, (7) 27 VIII 79, (8) 16 IX 78, (4) 20 IX 79; Mount Eddy (2) 6 VIII 78, 20 IX 79; cirque above Josephine Lake, 8 VIII 76; Caribou Lakes Trail (4), 10 VIII 76; Gumboot Lake, 11 VIII 76; lower Grizzly Meadows, 27 VIII 76, Dead Mule Camp, 5 IX 76; Union Creek Trail (7), 6 IX 76; Big Flat, 8 IX 76; Parker Meadow, 1 X 76. (24 VI - 1 X)

8. *Speyeria coronis* near *simaetha* dosPassos and Grey. Simaetha Fritillary.

Rather rare. Like *S. cybele leto*, this is a highly vagile species, especially females in autumn. It is often common in Plumas and Lassen Counties on the east slope of the Sierra and occurs at Mount Shasta City. It visits *Haplopappus*, *Chrysothamnus*, *Aster*, and other fall Composites and also *Monardella*; its light ground color and very strong silvering make it distinctive even on the wing. It prefers open, dry sites, usually near streams. Our material is smaller and lighter than ssp. *snyderi* Skinner from the Sierra Nevada.

HOST PLANTS: Unknown. Presumably violets.

RECORDS: 6.5 km W Callahan, 15 VI 80; 3.2 km W Gazelle, Robertson Ranch, 5 VII 80; Caribou Lakes Trail, 20 VII 68 (Emmel and Shields); Mount Eddy, 6 VIII 78; Packer's Peak (2), 15 VIII 77; Deadfall Lakes, 16 VIII 79, (2) 20 IX 79; Callahan, 20 IX 79. (15 VI - 20 IX)

9. *Speyeria zerene conchyliaetus* J. A. Comstock. Zerene Fritillary.

This richly-colored Fritillary is not very common in the Trinities, but females swarm by dozens on Rabbitbrush in Scott Valley in fall. In the montane coniferous forest belt it generally occurs in clearings and along trails, often in the company of the Pine White, Sandhill Skipper, and other species of *Speyeria*. Trinity specimens are mostly quite similar to the well-known ones from Anthony Peak on the east side of the North Coast Ranges, but Scott Valley ones are more ochreous above and less ruddy beneath.

HOST PLANTS: Undetermined; presumably violets.

RECORDS: Crawford Creek, 15 VI 80; 11 km E Callahan, 15 VI 80; Gulick Creek, 10 VII 77; Morgan Meadows (4), 12 VII 79; Caribou Lakes Trail, 10 VIII 76; vicinity of Big Flat (3), 7 IX 76; Deadfall Lakes, 16 VIII 79, 27 VIII 79, 16 IX 78, 20 IX 79; Callahan (4), 21 IX 79; French Creek (Scott Valley) (8), 21 IX 79. (15 VI - 21 IX)

10. *Speyeria callippe rupestris* Behr. Ruddy Silver-Spot.

With *S. egleis oweni*, this is the commonest Fritillary in the Trinity-Eddy area. It is also the earliest to emerge and is seldom collected after mid-July. It occurs along the edges of meadows and along trails and streams in montane coniferous forest, from foothill canyons to about 1800 m. It visits Pussy Paws (*Spraguea*), *Monardella*, and mud puddles.

Quite variable. To the east and north, transitional specimens to ssp. *elaine* dosPassos and Grey are occasionally found. One melanic male was taken at Packer's Peak, 9 VII 77.

HOST PLANTS: Not Determined; presumable *Viola*.

RECORDS: 11 km E Callahan (5), 15 VI 80; Callahan, 15 VI 80, 6.5 km W Callahan (2), 15 VI 80; Crawford Creek (2), 15 VI 80; Willow Creek (2) 16 VI 76; Morris Meadow (5), 17 VI 76, (4) 24 VI 76, (5) 26 VI 76; Lone Jack, 18 VI 77; Stuart Fork below Sawtooth Ridge (4) 24 VI 76, 25 VI 76, (2) 5 VIII 79; Deer Creek (3), 27 VI 76; Mumford Meadow (3) 25 VI 77; Coffee Creek, 1400 m (3), 26 VI 77; Packer's Peak trail (3), 9 VII 77; Morgan Meadows, 12 VII 79; Hobo Gulch (3), 18 VII 77; Deadfall Lakes (2), 27 VIII 79; Big Flat, 7 IX 76. (15 VI - 7 IX)

11. *Speyeria egleis oweni* Edwards. Owen's Silver-Spot.

Very common to abundant at higher elevations throughout the area. There is a gentle east-west cline; Mount Eddy specimens are more contrasty, with a more olivaceous ground color, especially in females, and a paler, more contrasting disc. These characters are developed still further on the south slope of Mount

Shasta. Trinity Alps *egleis* look more like the nominate Sierran subspecies, with which they do not exchange genes directly - this presumably represents parallel variation. Although all our series are variable, they do not approach the complexity of material from Westwood, Lassen County, and the very dark forms encountered there are completely absent.

This is our only Fritillary that hilltops regularly - even above tree line on Mount Eddy and on the bare granite of the high Trinities. Here it occurs with *Parnassius phoebus sternitzkyi* and *Pieris occidentalis*. Lower, it occurs in meadows and clearings in the upper montane coniferous forest. Its altitudinal range, 1500-2750 m, barely overlaps the preceding *S. callippe rupestris*. Its flight season is long. It visits flowers freely, especially *Monardella* and *Haplopappus*.

At Deadfall Lakes males average very small and flock to mud puddles. They are easily mistaken for *S. mormonia*. Trinity-Eddy *egleis* are much more ecologically versatile than their Sierran cousins, expanding their range into moist sites of the type occupied by *S. mormonia arge* Strecker in that range. We initially thought *mormonia* was absent from the area and that we were observing the phenomenon of ecological character release, but see under *S. mormonia* below.

HOST PLANTS: Unrecorded, but presumably on violets. (*Viola purpurea* Kell.-J. Emmel.)

RECORDS: Stuart Fork below Sawtooth Ridge, 25 VI 76; Packer's Peak summit (4), 9 VII 77; Morgan Meadows, 12 VII 79; Deadfall Lakes (3), 12 VII 79, 6 VIII 78, (15) 16 VIII 79, (8) 16 IX 78, (7) 20 IX 79; Sunrise Pass (9), 10 VII 77, 5 IX 76; Mount Eddy (3), 6 VIII 78, (5) 16 VIII 79, 27 VIII 79, 16 IX 78; Packer's Peak Trail, (4) 15 VIII 77; Caribou Lakes Trail (11), 10 VIII 76; Gumboot Butte (11), 11 VIII 76; Upper Grizzly Meadows (2), 27 VIII 76; Gulick Creek (4), 5 IX 76; Dead Mule Camp, 5 IX 76; Dorleska Mine (6), 7 IX 76; Big Flat, (4) 7 IX 76, 30 IX 76. (25 VI - 30 IX) 12.

Speyeria hydaspe purpurascens Henry Edwards. Purplish Silver - Spot.

Common in montane coniferous forest and at the edges of mid-elevation meadows, visiting *Monardella* with the other Fritillaries. Although our series includes a great deal of individual variation, there are no geographic trends apparent. The flight season is longer and the population density higher than for *hydaspe* in the northern Sierra Nevada.

HOST PLANTS: Undetermined; presumably *Viola*. (*V. sheltonii* Torr.-J. Emmel.)

RECORDS: Morris Meadow (2) 17 VI 76, (2) 24 VI 76, (3) 4 VIII 79; Deer Creek (2), 27 VI 76; Mumford Meadow, 25 VI 77; Packer's Peak Trail, 9 VII 77; Gulick Creek, 10 VII 77; Morgan Meadows (4), 12 VII 79; Hobo Gulch (4), 18 VII 77; Stuart Fork below Sawtooth Ridge (2), 5 VIII 79; Caribou Lakes Trail (6), 10 VIII 76; Union Creek Trail (2), 6 IX 76; Big Flat, 7 IX 76, 8 IX 76; Deadfall Lakes, 20 IX 79. (17 VI - 20 IX)

13. *Speyeria mormonia erinna* Edwards. Erinna Silver - Spot.

This was one of the great surprises of the survey. *Speyeria mormonia* is otherwise known only from the Sierra Nevada (*arge* Strecker, Yuba Pass south) and the Warner Mountains of Modoc County (? ssp.). *S. m. erinna* was previously known only from the east slope of the central Oregon Cascades. A single fresh male was taken on the uppermost grassy bog at Deadfall Lakes, 16 IX 78. A second male was taken at Deadfall Meadow on 27 VIII 79 (M. Mullins) and a female the same day on a hillside meadow-seeep north of the lower Deadfall Lakes (W. Patterson). All of these

lie outside the range of variation of Sierran *arge*. Because small *egleis* are so common in the Deadfall Lakes area, this butterfly is very easy to overlook. A careful search on 20 IX 79 in all the meadows failed to turn it up. Since we have large, essentially random collections of Fritillaries from the Trinities in autumn we feel confident that *mormonia* is restricted to the Deadfall Lakes - Mount Eddy part of our study area. The boggy meadow at Scott Mountain Summit, which is ecologically similar to Deadfall Meadow, should be checked slightly earlier in the season. J. Emmel suspect *Viola adunca* Sm. as the host plant. This species occurs at Deadfall and on Scott Mountain.

14. *Boloria epithore* near *chermocki* Perkins and Perkins. Chermock's Meadow Fritillary.

The Meadow Fritillary is common and generally distributed in wet meadows and bogs throughout the Trinity - Eddy area, and occasionally in drier places. Its elevational range is mostly 1200--2100 m. It usually flies with *Phyciodes campestris*, *Chlosyne hoffmanni segregata*, *Agriades glandon*, and *Thorybes mexicana aemilia*. Trinity - Eddy specimens are larger and less heavily patterned than northern Sierran ones.

HOST PLANTS: Again, presumably *Viola*. (*V. glabella* Nutt.? - J. Emmel.)

RECORDS: Boulder Creek, 12 VI 76; Mumford Meadow (2), 14 VI 76, (6) 25 VI 77; Parker Meadow, 14 VI 76; lower Bear Basin Meadow, 15 VI 76; Deadfall Meadow, 15 VI 80; Deer Creek, 16 VI 76, 27 VI 76; Willow Creek, 16 VI 76; Morris Meadow, 17 VI 76, (2) 24 VI 76; Emerald Lake, 25 VI 76; Gulick Creek, 10 VII 77; Deadfall Lakes (4), 12 VII 79, 16 VIII 79; Morgan Meadows (3), 12 VII 79; Gibson Meadow (2), 30 VII 76; Deadfall Meadow to lower Deadfall Lakes, 6 VIII 78. (12 VI - 16 VIII)

15. *Chlosyne leanira* Felder and Felder. Leanira Checkerspot.

Recorded from Crawford Creek (S.O.M. and 15 VI 80). Otherwise unrecorded from the region.

16. *Chlosyne palla* Boisduval. Northern Checkerspot.

A very common species from the foothills to about 1500 m, overlapping the next species altitudinally and in habitat. It prefers open, xeric sites, often on rocky slopes or at the foot of a cliff; it visits Pussy Paws (*Spraguea*) at the edges of dry montane meadows. Higher-elevation specimens tend to lose the black pattern, as is also observed in the Sierra Nevada. Most females are the dark form (*eremita*), with some intermediates and few fully light ones. A melanic male was taken on upper Stuart Fork, 24 VI 76, and minor "aberrations" are frequent.

HOST PLANTS: Probably Compositae. Suspect genera are *Aster*, *Senecio*, and *Solidago*.

RECORDS: Canyon Creek (3), 28 V 77; Scott Valley, 29 V 77, 15 VI 80; Shadow Creek, 29 V 77; Cecilville, 29 V 77; Boulder Creek, 12 VI 76; Eagle Creek (11), 14 VI 80; lower Coffee Creek (2), 14 VI 80; Crawford Creek (4), 15 VI 80; Callahan 15 VI 80; 6.5 km W Callahan, 15 VI 80; Morris Meadow, 17 VI 76, (2) 24 VI 76, (4) 26 VI 76; Lone Jack, 18 VI 77; Bridge Camp (2), 18 VI 76; Stuart Fork below Sawtooth Ridge (2), 24 VI 76; Coffee Creek, 26 VI 77; Deer Creek (6), 27 VI 76; Hobo Gulch, 18 VII 77. (28 V - 18 VII)

17. *Chlosyne hoffmanni segregata* Barnes and McDunnough. Hoffmann's Checkerspot.

Very common in wet meadows and bogs, but extending to drier, open sites as well. Its range commences at about 1400 m and reaches at least 2250. The

males cluster on mud puddles and may be collected ten at a time. Our entire series appears indistinguishable from Oregon Cascade material. There is no tendency to lose the outer discal pattern as in the nominate Sierran subspecies.

HOST PLANTS: Egg masses on *Aster ledophyllus* (Gray) Gray (Compositae), Caribou Lakes, 2100 m, 23 VII 68 (Emmel and Shields).

RECORDS: Emerald Lake, 25 VI 76; Sapphire Lake (3), 25 VI 76; base of Red Rock Mountain and Gulick Creek area (13), 10 VII 77; Deadfall Lakes (4), 12 VII 79, (6) 6 VIII 78; Grizzly Meadows (10), 19 VII 77; Granite Creek, 30 VII 76; Caribou Basin, 23 VII 68 (Emmel and Shields), 9 VIII 76. (25 VI - 9 VIII)

18. *Euphydryas chalcedona* Doubleday. Chalcedon Checkerspot.

(a) foothill populations

The large foothill-canyon members of this complex do not seem phenotypically different from northern Coast Range specimens, except for a tendency for the median band to be clouded with red-resembling in this regard mid-west Sierran-slope "*truceensis* Gunder" rather than the very red bog-meadow populations (*dwinellei* H. Edwards, *sperryi* Chermock and Chermock) from near Bartle, Siskiyou County. We have reared four south-slope Trinity larvae. All lacked the white stripes of *truceensis*, thus resembling Coast Range larvae.

Males patrol stream edges and roadsides and perch both on the ground and on tall plants. Male-male chases are frequent and prolonged. The more secretive females fly but little, but can be collected from Yerba Santa flowers with the males.

HOST PLANTS: Four larvae collected at Lone Jack, 28 V 77, from an undetermined shrubby *Penstemon* (Scrophulariaceae), were reared on *Plantago* and enclosed in late June-early July.

RECORDS: Coffee Creek, 850m, (4) 27 V 77, 14 VI 80; Coffee Creek, 1400 m, (18) 14 VI 80, (5) 26 VI 77; Lone Jack (2), 28 V 77, (5) 18 VI 77; Cecilville (2), 28 V 77; Crawford Creek (9), 15 VI 80; 6.5 km W Callahan (3) 15 VI 80; 11 km E Callahan (9), 15 VI 80. (27 V - 26 VI; based on rearing, perhaps extending to mid VII)

(b) subalpine populations

All our subalpine *Euphydryas* from the granite Trinities appear to be *chalcedona*. Most are quite red, but there is considerable variation and one male from Packer's Peak (where *chalcedona* co-occurs with *editha*, *q.v.*) is almost as black as foothill ones.

Common on granite scree, occasional on ultrabasics and metamorphics; males course up and down unstable, barren slopes, rarely if ever visiting flowers, and are difficult to net. They are highly territorial, displaying a mixture of perching and patrolling behavior. Females are much less often seen than males; ours are very red. We are unable to assign these populations to any subspecific name at this time.

HOST PLANTS: Emmel and Shields report two *chalcedona*-type egg masses on *Penstemon newberryi* ssp. *berryi* (Eastw.) Keck at Caribou Lake, 23 VII 68. This is one of several common high-altitude *Penstemon* (Scrophulariaceae) in the Trinities (Ferlatte, pp. 135-138). At Packer's Peak, where both *Euphydryas* occur, there are three *Penstemon*: *dauidsonii* Greene, *purpusii* Bdg., and the rare, endemic *tracyi* Keck - but not *newberryi*. Larvae and host records are urgently needed.

RECORDS: Sapphire Lake (2), 25 VI 76; Packer's Peak, 9 VII 77; base of Red Rock Mountain, 10 VII 77; Granite Lake, 31 VII 76; Emerald Lake, 5 VIII 79; Stuart Fork

below Sawtooth Ridge, 5 VIII 79; cirque above Josephine Lake, 8 VIII 76; Caribou Basin, 22 VII 68 (Emmel and Shields), (2) 9 VIII 76, 10 VIII 76. (25 VI - 10 VIII) 19. *Euphydryas editha* Boisduval. Editha Checkerspot.

(a) *foothill populations*

S. O. Mattoon has collected low-elevation *editha* near Crawford Creek and describes them as "near *edithana* Str.-nd," a northeastern California subspecies. According to M. Singer (*pers. comm.*) this population belongs to a *Collinsia*-feeding group (Scrophulariaceae).

(b) *subalpine population (near colonia Wright?)*

So far this entity has been found only on Packer's Peak, where it flies with subalpine *chalcona* over bare scree. It is very red, but there is extensive individual variation as is common with *editha*. We have searched unsuccessfully for subalpine *Euphydryas* on Mount Eddy, which is ecologically similar to the Red Trinities and Packer's Peak.

RECORDS: Packer's Peak (10), 9 VII 77.

20. *Phyciodes campestris campestris* Behr. Field Crescent.

The biogeographic independence of the Trinities from the Sierra is underscored by the absence of *P. c. montana* Behr, the light-colored montane subspecies of the Sierra, and its ecological replacement by nominate *campestris* which in the Sierra occurs in the foothills and from Yuba Pass north. The Field Crescent has been taken in the Trinity-Eddy area from foothills to about 2400 m. It is commonest in bogs and boggy meadows at 1500-2100 m, where its very long flight season indicates at least a partial second brood (in the Trinities, but perhaps not on Mount Eddy). Males fly swiftly over open, sedge areas. Females are often seen at flowers, especially various asters.

Nominate *campestris* ranges north to Arctic Alaska. It shows great phenotypic constancy over this vast region, although breaking into races in the Central Valley and southward.

HOST PLANTS: Compositae: *Aster ledophyllus* Gray (Gray) and *A. alpigenus* (T. and G.) Gray ssp. *andersonii* (Gray) Onno are both strongly suspected.

RECORDS: Parker Meadow (2), 14 VI 76, 5 IX 76; Willow Creek, 16 VI 76; Lone Jack, 18 VI 77; Morris Meadow, 24 VI 76; Mumford Meadow (17), 25 VI 77, (3) 5 IX 76; Deer Creek (7) 27 VI 76; Packer's Peak Trail, 9 VII 77; Gulick Creek (6), 10 VII 77; Scott Mountain Summit (3), 11 VII 77; Granite Creek, 30 VII 76; Deadfall Lakes (6), 12 VII 79, (4) 6 VIII 78, 27 VIII 79; Morgan Meadows (11), 12 VII 79; Granite Lake trail (4), 31 VII 76; Mount Eddy (10), 6 VIII 78; cirque above Josephine Lake, 8 VIII 76; Big Flat, 7 VIII 76; Dead Mule Camp (2), 5 IX 76; Union Creek Trail, 6 IX 76; Swift Creek (3), 1 X 76. (14 VI - 1 X)

21. *Phyciodes orseis orseis* Edwards. Orseis Crescent.

A rare, little-known species. Recorded at one locality in our survey and independently at the same locality by S. O. Mattoon. Flies along a sunlit stream in lower montane coniferous forest, with *Phyciodes mylitta*, *Papilio eurymedon*, *Parnassius clodius*, *Everes amyntula*, and *Pieris napi*. It is easily overlooked due to its similarity to the two common *Phyciodes*, with which it often flies. A number of California collectors have mistakenly classified large, richly colored female *P. campestris* as this species. Such females are especially common in Siskiyou County. More data on the ecological requirements of *P. o. orseis* are urgently needed.

On 26 VII 80 two males were taken on Deadfall Meadow among large numbers of *P. campestris*; both were fresh. This represents not only a range extension and a late seasonal record, but the highest elevation record for the species (2100 m +). *Cirsium breweri* is present.

HOST PLANTS: Not known locally, but *Cirsium breweri* (Gray) Jeps. (Compositae) is present in the habitat. (*C. cymosum* (Greene) Howell occurs on the higher slopes.) RECORDS: Crawford Creek (2), 29 V 77, 15 VI 80. (S.O.M. has additional records.)

22. *Phyciodes mylitta* Edwards. Mylitta Crescent.

Although the Mylitta Crescent is one of the commonest "weedy" butterflies on the Pacific Slope, it occurs in an unusual and restricted habitat in the Trinities - the mid-elevation bogs on serpentine drainages. Here it is locally common and double-brooded, feeding on a native thistle restricted to this habitat. Occasional specimens turn up in a variety of situations at lower elevations. It is possible that the smaller foothill and larger bog phenotypes represent genetically distinct entities, but specimens resembling Trinity bog ones do turn up elsewhere, mostly in late spring. The phenotype may simply reflect development on high-quality hosts. An extreme aberration of bog *mylitta* was taken 25 VI 77 at Mumford Meadow.

HOST PLANTS: Compositae: *Cirsium breweri* (Gray) Jeps., the bog thistle, at numerous locations in the Swift Creek drainage; larvae common much of the season, often defoliating the plants; not found on *C. breweri* at Deadfall Meadow in 1979. At Lone Jack, 18 VI 77, larvae common on the European weedy thistle *Cirsium vulgare* (Savi) Tenore.

RECORDS: Canyon Creek, 28 V 77; Cecilville, 29 V 77; Shadow Creek, 29 V 77; Crawford Creek, 29 V 77, 15 VI 80; Scott Valley, 29 V 77; 6.5 km W Callahan, 15 VI 80; Callahan, 15 VI 80; Morris Meadow, 17 VI 76; Stuart Fork below Sawtooth Ridge, 24 VI 76, (2) 5 VIII 79; Mumford Meadow (11), 25 VI 77; Coffee Creek, 1400 m, (6) 26 VI 77, 7 VII 77; Deer Creek (2) 27 VI 76; 3.2 km W Gazelle (3), 5 VII 80; Gulick Creek (2) 10 VII 77; base of Red Rock Mountain, 10 VII 77; Morgan Meadows (3), 12 VII 79; Hobo Gulch (3), 18 VII 77; Grizzly Meadows (5), 19 VII 77; Granite Lake (2), 31 VII 76; cirque above Josephine Lake, 8 VIII 76; Caribou Basin (4), 9 VIII 76; Packer's Peak trail, 15 VIII 77; Deadfall Meadow, 27 VIII 79, (3) 20 IX 79; Douglas City, 29 VIII 79; Dead Mule Camp, 5 IX 79; Union Creek trail (2), 6 IX 76; Deadfall Lakes (12), 16 IX 78; French Creek (Scott Valley), 21 IX 79; Big Flat (3), 24 IX 77, 30 IX 76; Swift Creek (7), 1 X 76. (28 V - 1 X)

23. *Polygonia satyrus* Edwards. Satyr Anglewing.

Rare in the Trinity-Eddy area, but recorded twice in one locality, in a riparian Black Cottonwood grove with nettle understory, flying with *Nymphalis milberti*, *Cartocephalus palaemon*, and *Papilio rutulus*.

HOST PLANTS: *Urtica holosericea* Nutt. strongly suspected.

RECORDS: Crawford Creek, 15 VI 80; Coffee Creek, 1400m, 26 VI 77, 7 VII 77. All hibernators. Also reported from below Deadfall Lakes (S.O.M.).

24. *Polygonia faunus rusticus* Edwards. Rustic Anglewing.

We have only three records of this insect, in widely separated and ecologically different sites - mid-elevation riparian forest, a boreal meadow on granite with willows and Mountain Hemlock, and the dry edge of a wet montane meadow on serpentine. Two of the specimens were taken on fall Composites (*Aster* and *Solidago*).

HOST PLANTS: *Salix* strongly suspected.

RECORDS: Coffee Creek, 1400 m, 7 VII 77 (2 hibernators); Caribou Basin, 9 VIII 76 (fresh); Deadfall Lakes, 16 IX 78 (fresh).

25. *Polygonia zephyrus* Edwards. Zephyr Anglewing.

This is the only common *Polygonia* in the area, occurring from about 1400 m to tree line and above (as a hilltopper). It often visits *Monardella* in the company of *Speyeria egleis oweni*, or *Chrysothamnus* with *Neophasia menapia*; in *Parnassius phoebus sternitzkyi* country it perches on rocks, or in sunlit glades along forest trails at lower altitudes. Worn hibernators have been taken as late as mid-August (Mount Eddy) and fresh specimens as early as mid-July. Trinity-Eddy *zephyrus* are browner beneath than Sierran ones, and tend to have little or no yellow on that surface.

HOST PLANTS: In the Sierra usually reported on *Ribes*, but in the Trinity-Eddy area females have been seen repeatedly in Willow (*Salix*) thickets.

RECORDS: Bear Basin (2), 15 VI 76; Stuart Fork below Sawtooth Ridge, 24 VI 76; Swift Creek, 25 VI 77; Coffee Creek, 1400 m (2), 26 VI 77; Packer's Peak (2), 9 VII 77, (3) 15 VIII 77; Sunrise Pass (2), 10 VII 77; Deadfall Lakes (2) 12 VII 79, (3) 6 VIII 78, (2) 16 IX 78; Grizzly Meadows (2), 19 VII 77; Mount Eddy (2), 6 VIII 78, 16 VIII 79; cirque above Josephine Lake (3), 8 VIII 76; Brown's Meadow, 10 VIII 76; NW shore Grizzly Lake, 27 VIII 76; lower Grizzly Meadow, 27 VIII 76; Yellow Rose Mine Trail, 5 IX 76; Dead Mule Camp (3), 5 IX 76; Dorleska Summit, 7 IX 76; Deadfall Meadow (4) 20 IX 79; Callahan, 21 IX 79; Swift Creek, 1 X 76. (15 VI - 1 X)

(25A. *Polygonia oreas silenus* Edwards. Silenus Anglewing.

A fresh male was taken 3.2 km W Gazelle, 5 VII 80 (J. Hayes). This is the only record of this very rare species near the study area.)

26. *Nymphalis milberti* Godart. Milbert's Tortoise Shell.

Frequent to common, from 1400 m to above tree line (as a hilltopper); often at *Monardella* flowers. The biology of this species in the West is poorly understood. It seems to undergo altitudinal migrations seasonally, but such phenomena are not apparent from our Trinity - Eddy records. All our specimens are strongly yellow-banded (*subpallida* Ckll.), but a very large series from Mount Shasta Ski Bowl, 16 VIII 77, shows extensive variation in this character.

Numbers of *Nymphalis milberti* were unusually high from 1977 through 1979, not only in the study area but throughout northern California. We did not see the species in 1976 and suspect its numbers fluctuate a great deal.

HOST PLANTS: Presumably *Urtica*, as elsewhere.

RECORDS: 6.5 km W Callahan, 15 VI 80; Callahan, 15 VI 80; 3.2 km W Gazelle, 15 VI 80; Coffee Creek, 1400 m, 26 VI 77; Deadfall Lakes, 12 VII 79, 6 VIII 78, (3) 16 IX 78, 20 IX 79; Mount Eddy summit (4) 6 VIII 78; Packer's Peak summit, 15 VIII 77. (15 VI - 20 IX)

27. *Nymphalis californica* Boisduval. California Tortoise Shell.

Generally common, occasionally migratory and abundant. Montane coniferous forest, and hilltopping on summits; on 6 VIII 78 hilltoppers were seen flying over snowdrifts atop Mount Eddy. No major outbreaks occurred during the survey. During such episodes, millions of Tortoise Shells may move through Shasta Valley. Non-migratory *californica* are often seen on *Monardella*, *Haplopappus bloomeri*, and mud puddles. This is one of the few Trinity-Eddy butterflies that will fly on cold, cloudy, even rainy days.

HOST PLANTS: Rhamnaceae: A colony of larvae on 28 V 77, Canyon Creek, defoliating *Ceanothus integerrimus* var. *californicus* (Kell.) Benson.

RECORDS: Crawford Creek (2), 15 VI 80; 6.5 km W Callahan, 15 VI 80; Callahan, 15 VI 80; Morris Meadow (2), 16 VI 76; Swift Creek, 25 VI 77; Emerald Lake, 25 VI 76; Deer Creek (2) 27 VI 76; Coffee Creek, 1400 m, 26 VI 77; Packer's Peak summit, 9 VII 77; Morgan Meadows, 12 VII 79; Mount Eddy summit, 6 VIII 78; Deadfall Meadow, 20 IX 79; Big Flat, 30 IX 76. (15 VI - 30 IX)

28. *Nymphalis antiopa* Linnaeus. Mourning Cloak.

Common and general in riparian habitat, along trails through montane coniferous forest, and at edges of wet meadows; foothills to 2100 m. Hibernators live into early August, but fresh specimens have been taken in late June in the foothills and mid-August at the upper limit of the range. Spring males are highly territorial.

HOST PLANTS: Larvae abundant on *Salix jepsoni* Schneid., Coffee Creek, 4500 feet, 7 VII 77.

RECORDS: Cecilville, 29 V 77; Boulder Creek, 12 VI 76; Callahan, 15 VI 80; Crawford Creek, 15 VI 80; 6.5 km W Callahan, 15 VI 80; Lone Jack, 18 VI 77; Swift Creek, 25 VI 77; Coffee Creek, 1400 m, 26 VI 77; Deadfall Lakes, 6 VIII 78; Gumboot Lake, 11 VIII 76; Packer's Peak trail, 15 VIII 77. (29 V - 15 VIII)

29. *Vanessa annabella* Field (*carye* auct.) West Coast Lady.

Occasional (Trinities) to common (Mount Eddy) in almost any open habitat; with on flowers - *Monardella*, *Chrysothamnus*, *Haplopappus* and *Aster* are all favorites - but sometimes seen perching in sunlit spots in trails or on streambanks, or on hilltops, usually in late afternoon. Apparently at least partially double-brooded.

HOST PLANTS: Malvaceae: *Sidalcea oregana* (Nutt.) Gray ssp. *spicata* (Regel) Hitchc. (Deadfall Lakes and Mumford Meadow, larvae).

RECORDS: Scott Valley, 15 VI 80; Mumford Meadow, 25 VI 77; Sunrise Pass, 10 VII 77; Deadfall Lakes, 6 VIII 78, (2) 16 IX 78, 20 IX 79; cirque above Josephine Lake, 8 VIII 76; Mount Eddy, 16 VIII 79; Union Creek trail (2), 6 IX 76; Dorleska Mine, 7 IX 76; Callahan, 21 IX 79. (15 VI - 21 IX)

30. *Vanessa virginiensis* Drury. American Painted Lady (Painted Beauty).

Frequent as a hilltopper; the commonest *Vanessa* at high elevations except during *cardui* migrations. Fresh specimens emerge in August and September and visit the fall Composites; perhaps only single-brooded at higher elevations.

HOST PLANTS: Compositae: *Gnaphalium palustre* Nutt., larvae, Big Flat, 15 VIII 77; *Anaphalis margaritacea* (L.) Benth., Lone Jack, 18 VI 77.

RECORDS: Deadfall Meadow, 15 VI 80; Swift Creek, 25 VI 77; Morris Meadow, 26 VI 76; Packer's Peak, 9 VII 77, (2) 15 VIII 77; Mount Eddy summit (3), 6 VIII 78; Caribou Lakes Trail, 10 VIII 76; Gumboot Butte, 11 VIII 76; Parker Creek trail (2), 6 IX 76; Dorleska Mine, 7 IX 76; Big Flat (2), 8 IX 76; Deadfall Lakes, 16 IX 78; Callahan, 21 IX 79. (15 VI - 21 IX)

31. *Vanessa cardui* Linnaeus. Painted Lady.

The Painted Lady, one of the world's most widely distributed butterflies, is irregular in its occurrence in the Trinity-Eddy area but is occasional in all open habitats from the foothills to 2700 + m. On September 20, 1979, hundreds were seen throughout the Eddies and Scott Valley, mostly feeding at flowers of Rabbitbrush (*Chrysothamnus*). These were probably migrating southward, as there

had not been any large-scale breeding locally in 1979. Migrating females generally have very large fat bodies and no ripe eggs.

HOST PLANTS: Extremely polyphagous. We have one larva from *Cirsium vulgare* (Savi) Tenore, Lone Jack, 28 V 77, and numerous empty nests on this plant and *C. breweri* (Gray) Jeps. (Compositae).

RECORDS: Coffee Creek Ranger Station, 27 V 77; Mumford Meadow, 25 VI 77; Coffee Creek, 1400 m, 26 VI 77; Packer's Peak (2), 9 VII 77, (2) 15 VIII 77; Morgan Meadows, 12 VII 79; Mount Eddy summit, 6 VIII 78, (3) 16 VIII 79; Deadfall Lakes (8), 20 IX 79; Callahan, 21 IX 79. (27 V - 21 IX)

32. *Vanessa atalanta* Linnaeus. Red Admiral.

The Red Admiral seems to be rare in the Trinity-Eddy region; we have only two records. The Douglas City male was taken on a roadside Yellow Star Thisle, the Canyon Creek one in a sunny glade among Yellow Pine and White Fir. Probably largely confined to foothill riparian and lower montane coniferous forest.

HOST PLANTS: Not determined; Urticaceae elsewhere.

RECORDS: Canyon Creek, 28 V 77; Douglas City, 2 X 76.

33. *Precis coenia* Huebner. Buckeye.

Common and general. The Buckeye occurs in all the meadows up to 2300 m at least, and in a variety of other habitats as a stray or casual. Its regular occurrence at high elevations is in striking contrast to the northern Sierra, where it is only a sporadic visitor above 1500 m most years. It seems unlikely that it is a permanent resident at high elevations in either range. The shorter distance from overwintering habitats in the foothills (sharper elevational gradient) may facilitate its colonizing Trinity meadows as compared to Sierran ones.

There is extensive individual variation; as usual autumn specimens, especially females, are often strongly reddish or purplish ventrally.

Adults regularly visit Pussy Paws and various Composites, including Rabbitbrush (*Chrysothamnus*). Males often perch in trails or on bare soil, darting out at anything that moves.

HOST PLANTS: No larvae collected in our survey; Scrophulariaceae and Plantaginaceae elsewhere.

RECORDS: Mumford Meadow, 14 VI 76, 25 VI 77; Morris Meadow, 17 VI 76, 24 VI 76, 26 VI 76, 14 VII 79, 4 VIII 79; Lone Jack, 18 VI 77, Deer Creek, 27 VI 76; Packer's Peak, 9 VII 77, (2) 15 VIII 77; Hobo Gulch, 18 VII 77; Deadfall Lakes, 12 VII 79, (3) 6 VIII 78, (12) 16 IX 78, 20 IX 79; Morgan Meadows, 12 VII 79; Grizzly Meadows (2) 19 VII 77; Big Flat, 4 IX 76, (2) 8 IX 76, (3) 24 IX 77; Gulick Creek, 5 IX 76; Dead Mule Camp, 5 IX 76; Dicleska Mine (2), 7 IX 76; Callahan, 21 IX 79; French Creek (Scott Valley) (2) 21 IX 79; Swift Creek, 1 X 76; Douglas City (4), 2 X 76. (14 VI - 2 X)

34. *Limenitis lorquini* Boisduval. Lorquin's Admiral.

Common near willows, foothills to 2100 m. Males often perch on sunlit branches. Trinity-Eddy specimens are usually reddish-orange tinted beneath with extensive black areas, with little bluish-white. In this they resemble Coast Range specimens, tending toward ssp. *burrisonii* Maynard of the Pacific Northwest; Sierran specimens and those from the Central Valley are usually whitish. One female from Morris Meadow, 17 VI 76, has a complete dorsal orange spot-band on the hind wing.

Two broods below 1500 m; perhaps only one at the upper end of the range at least in some years.

HOST PLANTS: *Salix* spp. strongly suspected.

RECORDS: Lone Jack, 28 V 77, (2) 18 VI 77; lower Coffee Creek (2) 14 VI 80; Crawford Creek, 15 VI 80; 5 km W Callahan, 15 VI 80; Morris Meadow, 16 VI 76, 17 VI 76, 4 VIII 79; Mumford Meadow, 25 VI 77; Coffee Creek, 26 VI 77; Packer's Peak Trail, 9 VII 77; Granite Lake Trail, 31 VII 76; Emerald Lake, 5 VIII 79; Mount Eddy, 6 VIII 78; cirque above Josephine Lake, 8 VIII 76; Brown's Meadow, 10 VIII 76; Union Creek Trail, 6 IX 76; Deadfall Lakes, 16 IX 78; Scott Valley, 21 IX 79. (28 V - 21 IX)

35. *Adelpha bredowii californica* Butler. California Sister.

Common in the foothills and lower montane coniferous forest, where it is clearly double-brooded. Strays to 2100+ m. Males patrol roads, trails, and creek bottoms, usually near oaks. Neither sex has ever been seen on flowers in the Trinities, but taken at *Chrysothamnus* on the banks of the Scott River. There is virtually no variation in this species.

HOST PLANTS: *Quercus* spp. suspected.

RECORDS: Canyon Creek, 28 V 77; Deadfall Meadow, 15 VI 80; 11 km E Callahan, 15 VI 80; lower Coffee Creek canyon, 14 VI 80; Morris Meadow, 16 VI 76, 17 VI 76; Willow Creek (2), 16 VI 76; Lone Jack, 18 VI 77; Swift Creek, 25 VI 77, 1 X 76; Coffee Creek, 26 VI 77; Sunrise Creek, 5 IX 76; Deadfall Lakes (3), 16 IX 78, 20 IX 79; Callahan, 21 IX 79; Big Flat, 30 IX 76. (28 V - 1 X)

RIODINIDAE

36. *Apodemia mormo* Felder and Felder. Mormon Metalmark.

Like *Cercyonis pegala boopis*, this species has disjunct populations at various altitudes scattered within the study area. It also seems to fluctuate markedly in numbers from year to year. Foothill populations are associated with an *Eriogonum* of the *latifolium* group in hot, dry canyons; montane - subalpine ones, with a member of the *E. umbellatum* complex, mostly on ultrabasics. The specimens seem phenotypically identical, and are very dark and blackish. Subalpine ones fly with the Blue Copper, *Lycaena heteronea*. They visit blossoms of *Chrysothamnus* and *Haplopappus bloomeri* as well as those of the host plant. They spend a great deal of time walking about, waving their wings, and are very difficult to follow once in the air.

HOST PLANTS: (foothill) *Eriogonum nudum* ssp. *sulphureum* (Greene) Stokes at Carrville; the same plant is used in the Klamath River country farther north. (subalpine) *E. umbellatum* Torr. complex (Gulick Creek, Dorleska Mine).

RECORDS: *Foothill*: Rte. 3, milepost TR47.00, 1200 m, 7 VIII 76; Carrville, 7 VIII 76. *Subalpine*: Packer's Peak (2) 15 VIII 77; Yellow Rose Mine Trail (2) 5 IX 76; Gulick Creek (2) 5 IX 76; Parker Creek Trail and Divide (4) 6 IX 76; Dorleska Mine (10), 7 IX 76; Dorleska Summit (2) 7 IX 76; Big Flat (2), 8 IX 76; Deadfall Lakes (2) 16 IX 78, 20 IX 79 (7 VIII, 15 VIII - 20 IX)

LYCAENIDAE

37. *Lycaena arota* Boisduval. Tailed Copper.

Frequent to locally common in alder thickets by streamsides in montane coniferous forest; occasionally at edges of meadows, perching on twigs in dappled light and shade. The Tailed Copper emerges late in the season. Unlike Sierra populations, Trinity-Eddy *arota* rarely visit flowers, but we have records at *Eriogonum umbellatum*, *Chrysothamnus*, and *Aster*, and at mud puddles.

Variation in this species is complex. There seems to be a double cline, elevational and directional. The darkest specimens are from lower elevations in the

western and southern parts of the area, the lightest from the east slope of the Trinities and the Eddies. The dark specimens resemble those from 1500 m on the Sierran west slope, while the light ones are more like those from 2100 m. All the North Coast specimens we have seen are of the dark phenotype.

HOST PLANTS: Undetermined; *Ribes* elsewhere.

RECORDS: Stuart Fork below Sawtooth Ridge (4) 5 VIII 79; Deadfall Lakes, 6 VIII 78, (5) 16 IX 78; Packer's Peak Trail (12), 15 VIII 77; Yellow Rose Mine Trail (8), 5 IX 76; Dead Mule Camp (9), 5 IX 76; Union Creek Trail (6), 6 IX 76; Dorleska Mine (3), 7 IX 76; Big Flat (5), 7 IX 76, (10) 8 IX 76; Deadfall Meadow, 20 IX 79. (5 VIII - 20 IX)

38. *Lycaena gorgon* Boisduval. Gorgon Copper.

Frequent in foothill canyons, reaching the lower montane coniferous forest and straying higher. One brood in late spring. The biology of this species in the northern mountains has received little attention. It is much commoner farther east.

HOST PLANTS: Polygonaceae: *Eriogonum nudum* complex suspected.

RECORDS: Lone Jack, 28 V 77, 18 VI 77; Crawford Creek (5), 15 VI 80; 6.5 km W Callahan, 15 VI 80; Callahan (3), 15 VI 80; 11 km E Callahan, 15 VI 80; Swift Creek trailhead, 25 VI 77; slope below Grizzly Meadow, 18 VII 77. (28 V - 18 VII)

39. *Lycaena heteronea* Boisduval. Blue Copper.

The Blue Copper is very abundant in the subalpine zone, where it seldom strays more than a few m from its host plant. It prefers barren, rocky sites - reaching its greatest densities on serpentine talus and vegetated mine tailings. Females are extremely variable, ranging from light forms resembling the relict Coast Range populations to very dark ones scarcely distinguishable from the Rocky Mountain subspecies *gravenotata* Klots, and blue ones almost indistinguishable from southern California *clara* H. Edwards. Sierran populations are much less variable, and tend to have strongly yellowish females. Populations similar to ours have been found in the Yolla Bollys by S. O. Mattoon.

Males are "perchers" and return repeatedly to the same site if disturbed. Females are usually found on flowers of the host. The commonest butterfly associates are *Hesperia juba* and *Apodemia mormo*.

HOST PLANTS: Polygonaceae: *Eriogonum umbellatum* Torr. complex.

RECORDS: above Gibson Meadows, 30 VII 76; Granite Creek (3), 30 VII 76; Emerald Lake, 5 VIII 79; ledge above Josephine Lake, 8 VIII 76; cirque above Josephine Lake, 8 VIII 76; upper Caribou Lakes Trail, 1900 m, 10 VIII 76; Packer's Peak (6), 15 VIII 77, 30 IX 76; Deadfall Lakes (2) 16 VIII 79, 27 VIII 79; Sunrise Pass, 5 IX 76; Sunrise Creek (2), 5 IX 76; Gulick Creek (14), 5 IX 76; Dorleska Mine (27), 7 IX 76; Mount Eddy (2), 16 IX 78. (30 VII - 30 IX)

40. *Lycaena nivalis* Boisduval. Nivalis Copper.

Very common throughout the montane and subalpine zones, occurring at edges of dry meadows, on rocky slopes and along trails, usually in full sun; visits Pussy Paws (*Spraguea*) freely. Trinity-Eddy populations are strikingly two-toned beneath; this phenotype occurs northward into Oregon and east to the Warner Mountains but not in the Sierra Nevada. A few males have the red subterminal line above concolorous with the ground. Single-brooded, but with a very long flight season.

HOST PLANTS: Polygonaceae: *Polygonum spergulariaeforme* Meissn. very

strongly suspected. This plant is much commoner and more widespread in the Trinity-Eddy region than the usual Sierran host, *P. douglassii* Greene, to which it is closely related.

RECORDS: Morris Meadow, 17 VI 76, (4) 24 VI 76, 26 VI 76; Mumford Meadow (4) 25 VI 77; Sapphire Lake (2), 25 VI 76; Deer Creek (2), 27 VI 76; Coffee Creek, 4500 feet, 7 VII 77; Packer's Peak Trail (2) 9 VII 77; Morgan Meadows (2), 12 VII 79; Grizzly Meadows (3), 19 VII 77; above Gibson Meadows, 30 VII 76; Emerald Lake, 5 VIII 79; Deadfall Lakes, 6 VIII 78, (2) 16 VIII 79, (2) 27 VIII 79, (2) 16 IX 78; Mount Eddy (3) 6 VIII 78; cirque above Josephine Lake (8), 8 VIII 76; Caribou Basin (3), 9 VIII 76; Brown's Meadow, 10 VIII 76; Union Creek Trail (3), 6 IX 76; Deadfall Meadow, 20 IX 79. (17 VI - 20 IX)

41. *Lycaena mariposa* Reakirt. Mariposa Copper.

Common in small glades and at the edges of meadows among Lodgepole Pines, at the upper end of the montane coniferous forest, and in the smaller subalpine meadows of the Caribou Basin; frequently found on flowers of *Helenium bigelovii* Gray - a plant rarely visited by butterflies - and of *Aster alpigenus* ssp. *andersonii* (Gray) Onno (both Composites). Both sexes usually sit well off the ground and can thus be told quickly from the preceding *L. nivalis* at a distance.

Trinity-Eddy specimens average more heavily marked beneath than Sierran ones from similar elevations and habitats.

HOST PLANTS: Unknown. (Rosaceae: *Horkelia* and *Potentilla* suspected in the Sierra.)

RECORDS: Scott Mountain Summit, 11 VII 77; Mount Eddy (3), 6 VIII 78, 27 VIII 79; Deadfall Meadow, 6 VIII 78, 16 VIII 79; cirque above Josephine Lake (4), 8 VIII 76; Caribou Basin (10), 9 VIII 76; upper Caribou Lakes Trail, 10 VIII 76. (11 VII - 16 VIII)

42. *Lycaena helloides* Boisduval. Purplish Copper.

This is a weedy, low-elevation species in most of California. It occurs sporadically in the southern foothills but is abundant in fall in Scott Valley, where it must be double-brooded. In the Trinities and Eddies it occurs sporadically but can be locally common, suggesting temporary local breeding. Autumn adults visit flowers of *Aster* and *Chrysothamnus*.

HOST PLANTS: Unknown locally, but both *Rumex crispus* and *R. acetosella* (Polygonaceae) are common in Scott Valley; the former occurs along Coffee Creek road and the latter is a widespread montane weed.

RECORDS: Coffee Creek, 850 m (5) 27 V 77, 14 VI 80; 3.2 km W Gazelle, 15 VI 80, 5 VII 80; 6.5 km W Callahan, 15 VI 80; Callahan, 15 VI 80, 21 IX 79; Mumford Meadow (2), 25 VI 77; Coffee Creek, 1400 m, (3) 26 VI 77; Morris Meadow, 14 VII 79; Packer's Peak trail, 15 VIII 77; Deadfall Lakes (10), 16 IX 78, 20 IX 79; Edgewood, 20 IX 79; French Creek (Scott Valley) (9), 21 IX 79. (27 V - 21 IX)

(42A. *Lycaena editha* Mead. Edith's Copper.

Occurs 3.2 km W Gazelle, B. Robertson ranch, 5 VII 80. Unrecorded in study area.)

43. *Habrodais grunus* Boisduval. Canyon Oak Hairstreak.

Common on dry slopes in montane chaparral, and in hot foothill canyons, wherever Canyon Oak (Goldencup Oak), *Quercus chrysolepis*, grows; also found once with *Q. vaccinifolia*, but never with *Q. garryana*. The butterflies sit in the oaks, from which they may be startled with a net, but do not visit flowers. They are most

active in late afternoon, when multiple male - male chases are common. One brood, flying in late summer. There is considerable variation, from quite light (mostly east slope and Mount Eddy) to dark (south slope of Trinities; resembles Coast Range material). We were surprised to find this species so common to such high elevations, as it rarely goes over 1500 m in the mid-Sierra, and then only in the most xeric sites. HOST PLANTS: Fagaceae: *Quercus chrysolepis* Liebm. (slope above Big Flat); possibly also *Q. vaccinifolia* Kell. (Sawtooth Ridge).

RECORDS: Hobo Gulch (4), 18 VII 77; Granite Creek, 30 VII 76; Deadfall Lakes (4), 6 VIII 78, (6) 16 IX 78; south slope Sawtooth Ridge, 2000 m, 8 VIII 76; Packer's Peak Trail (4) 15 VIII 77; Bob's Farm, 27 VIII 76; Papoose Lake Turnoff (2), 27 VIII 78; Sunrise Creek, 1900 + m, 5 IX 76; Yellow Rose Mine Trail to Big Flat (2) (common), 7 IX 76; Dorleska Summit (2), 7 IX 76. (18 VII - 16 IX)

44. *Strymon melinus* Huebner. Common or Gray Hairstreak.

This widespread, weedy lowland species occurs as a rare stray in the Trinity-Eddy area, apparently much less often than in the Sierra Nevada.

HOST PLANTS: Highly polyphagous: Malvaceae, Leguminosae, *Eremocarpus*, etc.; no breeding known locally.

RECORDS: Lone Jack, 28 V 77; Deadfall Lakes, 16 IX 78; Douglas City, 2 X 76.

45. *Satyrium californica* Edwards. California Hairstreak.

This species is recorded in five localities. Two are subalpine and are among the highest records in the state. The specimens are large, very dark, and heavily marked and were taken on the host and at yellow composites, including *Haplopappus bloomeri* and *Solidago multiradiata*. They resemble Great Basin and Sierran east-slope specimens; while lower-elevation Trinity examples are more "normal" Californian. This situation deserves further study.

HOST PLANTS: Rhamnaceae: Oviposition observed on Tobacco Brush, *Ceanothus velutinus* Dougl. ex Hook., Packer's Peak.

RECORDS: Foothill: Coffee Creek, 850 m, 14 VI 80; Crawford Creek, 15 VI 80. Subalpine: S slope Russian Peak (7), 15 VI 80; Packer's Peak (6), 15 VIII 77; Deadfall Lakes, 16 VIII 79.

46. *Satyrium sylvinus* Boisduval. Sylvan Hairstreak.

Recorded from the foothills into the montane zone (fairly typical phenotypes), and (much later in the season) in boggy high-montane and subalpine boggy meadows with willow (very dark, the ventral spots more distinctly ocellate). Apparently always rare in the study area. Similar altitudinal populations occur in the northern Sierra Nevada.

HOST PLANTS: Willows (*Salix*) strongly suspected.

RECORDS: Foothill: Lone Jack (2), 28 V 77; Coffee Creek, 1400 m, 7 VII 77; Hobo Gulch (2), 18 VII 77. Montane/Subalpine: Emerald Lake, 5 VIII 79; Stuart Fork below Sawtooth Ridge (2), 5 VIII 79; Deadfall Lakes, 6 VIII 78, 16 VIII 79, (8) 16 IX 78; Packer's Peak Trail (4), 15 VIII 77; Sunrise Creek, 5 IX 76. (28 V - 18 VII; 5 VIII - 16 IX)

47. *Satyrium saepium* Boisduval. Hedgerow Hairstreak.

Locally common in foothill chaparral - mostly on serpentine - and again in montane chaparral, as at Big Flat. As with the preceding species, there is great variation in flight season with altitude and exposure, but here the phenotype is invariant. An avid flower visitor, especially to *Ceanothus*, *Eriogonum* spp.,

Haploxyppus bloomeri, and *Chrysothamnus*.

HOST PLANTS: Undetermined locally; *Ceanothus* spp. likely.

RECORDS: lower Coffee Creek canyon, 750 m, 14 VI 80; Crawford Creek, 15 VI 80; 11 km E Callahan, 15 VI 80; Callahan, 15 VI 80; 6.5 km W Callahan, 15 VI 80; Coffee Creek, 1400 m, 7 VII 77; Morgan Meadows (4), 12 VII 79; Emerald Lake, 5 VIII 79; Carrville, 7 VIII 76; Packer's Peak trail (4), 15 VIII 77; Sunrise Creek, 5 IX 76; Parker Creek trail (7), 6 IX 76; Big Flat, 8 IX 76; Deadfall Lakes (5), 16 IX 78, 20 IX 79; Gazelle, 25 IX 77. (14 VI - 25 IX)

(47A. *Satyrium tetra* Edwards. Gray Hairstreak.

Occurs on the north slope of Mount Shasta (Military Pass Road area, near Hwy. 97), associated with Mountain Mahogany, *Cercocarpus ledifolius* Nutt., in arid montane - subalpine chaparral. This plant is abundant on Packer's Peak, above Deadfall Lakes and the south arm of Mount Eddy; the butterfly has been searched for carefully but not found. One male at a yellow composite on Russian Peak, 15 VI 80.)

(47B. *Satyrium behrii* Edwards. Behr's Hairstreak.

Has not been found in the Trinity-Eddy region despite assiduous search. Its host plant, *Purshia tridentata* (Pursh.) DC., occurs in a matted subalpine form at Packer's Peak and Dorleska Summit; it has not been seen on Mount Eddy. In the Sierra Nevada *S. behrii* does not occur in the subalpine zone either, except as a rare casual.)

48. *Satyrium fuliginosum* Edwards. Dusky Gossamer - Wing.

Trinity Alps specimens can be assigned to an undescribed subspecies which differs from Sierran material in the following characteristics: forewing broader, higher angled, especially in females; large, females often much larger than any Sierran ones; ventral forewing apex and hindwing of fresh specimens overscaled with white scales, giving a frosted or even ice-green effect; remainder of ventral forewing intensely black, especially in males; spot-pattern weak, less developed than in the Sierra Nevada. Mount Eddy and Gumboot Lake (Trinity Divide) specimens are less distinctive and seem intermediate to Sierran ones.

Our populations are virtually restricted to the subalpine zone, mostly on ultrabasics; ranging above tree line on Mount Eddy. Males perch on shrubs, especially *Quercus vaccinifolia* and *Cercocarpus ledifolius*, on rocky summits; their aerial chases are swift and spectacular, often poised in the air over sheer cliffs of 100 m or more. Both sexes visit flowers of *Eriogonum*, *Monardella*, and *Chrysothamnus*; females fly but little.

HOST PLANTS: *Lupinus croceus* Eastw. (Sunrise Pass, Sunrise Creek, Red Rock Mountain, Dorleska Summit, Gumboot Butte, Deadfall Lakes, Mount Eddy). Eggs are laid either on the plants or in litter around the plants; oviposition occurs infrequently amid much walking up and down the plants, on bare ground, etc. *L. croceus* is strictly endemic to ultrabasics in the Trinities and Mount Eddy. Emmel and Shields reported finding *S. fuliginosum* on granite (Sawtooth Ridge) in 1968 and saw ovipositions on *Lupinus albicaulis* Dougl. ex Hook. there and at Brown's Meadow. We have not found the insect at either location. *L. albicaulis* is the commonest lupine in montane coniferous forest in the region, mostly on non-ultrabasic soils, and its distribution correlates very poorly with that of *S. fuliginosum*.

RECORDS: Gibson Meadows (3), 30 VII 76; Granite Lake (4) 30 VII 76, (12) 31 VII 76 (apparently on the ultrabasic side of a geologically divided basin); between Granite Lake and Deer Creek, 31 VII 76; Deadfall Lakes, 6 VIII 78, (6) 16 VIII 79, (3) 27 VIII 79, 20 IX 79; Mount Eddy (6), 6 VIII 78; Gumboot Butte and Lake (3), 11 VIII 76; Sunrise Pass - Red Rock Mountain, common, 5 IX 76; above Dead Mule Camp, 5 IX 76; Dorleska Summit, 7 IX 76. (30 VII - 20 IX)

NOTE: The Trinity phenotype was figured in color by Comstock (1927), pl. 50, figs. 26 and 28. Compare to fig. 27, from Placer County.

49. *Mitoura spinetorum* Hewitson. Thicket Hairstreak.

This is the only species recorded in the Trinity Alps which we did not find in our survey. Emmel and Shields record "several at mud along the trail" at Brown's Meadow, 20 VII 68. This is a very sporadic, unpredictable species in northern California. Brown's Meadow does not seem a particularly good-looking place for it; we have sought it without success on *Chrysothamnus* at Mount Eddy, in Scott Valley, and on the north slope of Mount Shasta.

50. *Mitoura nelsoni* Boisduval. Nelson's Hairstreak.

Very abundant from the foothills to 1500 m, mostly at edges of meadows within montane coniferous forest, along trails, or in clearings where young Incense Cedars are invading sunlit areas. Adults swarm over flowering Pussy Paws and also visit *Ceanothus* and *Eriophyllum* (Compositae). There is considerable minor variation, but absolutely no tendency toward a *muiri* phenotype. Trinity - Eddy specimens are phenotypically and ecologically indistinguishable from Sierran west-slope ones.

HOST PLANTS: Cupressaceae: *Calocedrus decurrens* (Tour.) Flor.

RECORDS: Canvon Creek (3), 28 V 77; lower Coffee Creek (4), 14 VI 80; Crawford Creek, 15 VI 80; Deadfall Meadow, 15 VI 80; 11 km E Callahan (2), 15 VI 80; 6.5 km W Callahan, 15 VI 80; Deer Creek trail, 16 VI 76; Boulder Creek trail, 12 VI 76; Morris Meadow (4), 17 VI 76, (10) 24 VI 76; Willow Creek, 16 VI 76; Bridge Camp, 18 VI 76; Stuart Fork below Sawtooth Ridge, 24 VI 76; Mumford Meadow (4), 25 VI 77; Yellow Rose Mine Trail (3), 10 VII 77; Morgan Meadows (2), 12 VII 79. (28 V - 12 VII)

51. *Incisalia eryphon* Boisduval. Western Pine Elf.

Frequent in montane coniferous forest, generally as male singletons perching on small trees in sunlit glades or at the edges of streams. It may be very common at yellow composites along the road from Cecilville to Callahan to Gazelle. There are no phenotypic differences from Sierran material.

HOST PLANTS: Presumably Pinaceae.

RECORDS: Coffee Creek, 27 V 77, (2) 14 VI 80; Shadow Creek, 29 V 77; Cecilville, 29 V 77; Deadfall Meadow, 15 VI 80; 11 km E Callahan (6) 15 VI 80; 6.5 km W Callahan, 15 VI 80; Crawford Creek, 15 VI 80; Deer Creek, 15 VI 76, 27 VI 76; Grizzly Meadows, 19 VII 77. (27 V - 19 VII)

52. *Incisalia iroides* Boisduval. Western Brown Elf.

Not very common, mostly in montane chaparral, near *Quercus vacciniifolia*. Phenotypically indistinguishable from Sierran material.

HOST PLANTS: Unknown locally. A polyphagous species, recorded elsewhere on *Ceanothus*, Ericaceae, *Chlorogalum*, *Cuscuta*, etc.

RECORDS: Lone Jack, 28 V 77; Foster's Cabin, 13 VI 76; Coffee Creek, 800 m, 14



Fig. 1. Some Trinity-Eddy rarities or endemics, upper surfaces. *Speyeria mormonia erinna*: male, 16 IX 78, female, 27 VIII 79, both Deadfall Lakes; light *Hesperia harpalus*, N slope Mt. Shasta, 15 VIII 79; dark *H. harpalus*, Callahan, 21 IX 79; *Parnassius phoebus sternitzkyi*, Mt. Eddy summit, 6 VIII 78; *Agriades glandon*, Mt. Eddy, 6 VIII 78 (2); *Polites sabuleti*, Deadfall Lakes, 29 IX 79 (2); *Thorybes mexicana aemilia*, Mt. Eddy, 6 VIII 78 (2); *Satyrium fuliginosum* male, Gibson Meadows, 30 VII 76.

VI 80; Crawford Creek, 15 VI 80; 11 km E Callahan (3), 15 VI 80; 6.5 km W Callahan (3) 15 VI 80; Swift Creek, 25 VI 77; Coffee Creek, 1400 m, 26 VI 77; Mount Eddy summit, 6 VIII 78. (28 V - 6 VIII)

(52A. *Incisalia fotis windi* Clench. Wind's Hairstreak.

Not yet recorded in the study area, though it is known to occur in Trinity County. Eggs and larvae are more often collected than adults; we have searched two prospective hosts, *Sedum spatulifolium* Hook. in foothill canyons and *S. obtusatum* Gray (ssp. *boreale* Clausen) in the subalpine zone, in numerous locations without success.)



Fig. 2. Same as Fig. 1, under surfaces.

53. *Callophrys dumetorum* Boisduval. Bramble Hairstreak.

We have only one record, a worn female taken from *Vicia* flowers, and are unable to say if this is ssp. *oregonensis* Gorelick.

HOST PLANTS: Reported elsewhere on *Lotus* and *Eriogonum*.

RECORDS: Cecilville, 29 V 77.

54. *Callophrys lemberti* Tilden. Lambert's Hairstreak.

Frequent in subalpine and alpine "rock gardens," emerging immediately after snowmelt. Associated with the subalpine Trinity *Euphydryas*.

Adults visit flowering *Eriogonum* as well as small Composites. Females are redder above than Sierran *lemberti*. According to Gorelick, the northwest California populations deserve further taxonomic study.

HOST PLANTS: None confirmed. A female was collected on a budding (not flowering) *Eriogonum compositum* Dougl. ex Benth. above Sapphire Lake, but oviposition was not observed and no egg was found.

RECORDS: Lion Lake Trail, 13 VI 76; Sapphire Lake (2) 25 VI 76; Packer's Peak (2), 9 VII 77; Sunrise Pass, 10 VII 77. Recorded by S.O.M. on ridgetop NE of

Crawford Creek, and on Mount Eddy. (13 VI - 10 VII)

55. *Euphilotes battoides intermedia* Barnes and McDunnough. Square-Spotted Blue.

Frequent. Males are usually taken on mud puddles along trails and at edges of streams. Both sexes can be found around *Eriogonum umbellatum*, flying with *Plebeius lupini*, before either *Apodemia mormo* or *Lycaena heteronea* appears. Populations are known from the foothills to tree line.

HOST PLANTS: Either *Eriogonum marifolium* Torr. & Gray or *E. umbellatum* (both present).

RECORDS: Scott Valley, 29 V 77; Coffee Creek, 1400 m, 26 VI 77; Packer's Peak trail, 9 VII 77; Deadfall Lakes, 12 VII 79, 6 VIII 78; Grizzly Meadows, 10 VII 77; Gibson Meadows, 30 VII 76; Granite Lake (2), 31 VII 76; Mount Eddy (2), 6 VIII 78; Packer's Peak Summit, 15 VIII 77. (29 V - 15 VIII)

56. *Euphilotes enoptes enoptes* Boisduval. Dotted Blue.

Frequent but less widespread than the preceding, from which it is not displaced seasonally here or in the northern Sierra. The two have been found together only at Deadfall Lakes, and seem to be associated with different *Eriogonums*. Our records are from the foothills to 1150 m.

HOST PLANTS: At Lone Jack closely associated with *Eriogonum nudum* ssp. *sulphureum* (Greene) Stokes. Near Deadfall Meadow, on a white-flowered member of the same complex.

RECORDS: Lone Jack (4), 28 V 77, (3) 18 VI 77; Cecilville (2), 29 V 77; lower Coffee Creek, 14 VI 80; 6.5 km W Callahan, 15 VI 80; Callahan (3) 15 VI 80; Morris Meadow, 17 VI 76; Coffee Creek, 1400 m, 26 VI 77; Deadfall Meadow to Deadfall Lakes (2), 6 VIII 78. (28 V - 6 VIII)

57. *Glaucopsyche piasus* Boisduval. Arrowhead Blue.

One of the rarest Trinity butterflies. We have three singletons and know nothing of its ecology except that all are males taken in flowery roadside banks in the montane coniferous forest zone. The two Coffee Creek specimens were taken in the same, exact spot - 3 years apart.

In 1980 two more localities were added: Yellow Rose Mine Trail (1 ♂) and just below Sunrise Pass (2 ♀), all 27 VII 80. The two Sunrise Pass animals (2100 m) are smaller and darker than lower-elevation ones. They were very fresh.

HOST PLANTS: Unknown; *Lupinus* elsewhere.

RECORDS: Coffee Creek, 850 m, 27 V 77, 14 VI 80; Lion Lake trail, 13 VI 76.

58. *Glaucopsyche lygdamus incognitus* Tilden. Silvery Blue.

Common in lower Coffee Creek Canyon. Otherwise generally scarce, occurring mostly in moist, grassy situations where tall lupines grow; found once above tree line. In the Red Trinities it often occurs on the *Darlingtonia* bogs.

Variation in this species is complex. Our low-elevation series is fairly typical *incognitus*. High-elevation specimens resemble *columbia* Skinner, while our only Scott Valley specimen, a female, is strikingly different from both - fawn-gray beneath, with very large black spots. The Trinity-Eddy area may thus be one of rapid subspecific transition.

HOST PLANTS: Leguminosae: *Lupinus latifolius* Agardh. strongly suspected on the bogs. In lower Coffee Creek Canyon associated with weedy (introduced) *Vicia*

spp. and the native *Lathyrus jepsonii* ssp. *californicus* (Wats.) Hitchc. Host on Mount Eddy unknown.

RECORDS: Coffee Creek, to 1000 m (25), 27 V 77; Canyon Creek (2), 28 V 77; Scott Valey, 29 V 77; Lone Jack, 28 V 77; Lion Lake Trail, 13 VI 76; Bear Basin, 15 VI 76; Deadfall Meadow, 15 VI 80; 6.5 km W Callahan, 15 VI 80; Willow Creek (2), 16 VI 76; Morris Meadow, 17 VI 76; Deer Creek, 27 VI 76; Mount Eddy, near summit, fresh, 6 VIII 78. (27 V - 6 VIII)

59. *Celastrina argiolus echo* Edwards. Echo Blue.

The commonest Blue in the Trinity-Eddy region, ranging from the foothills to subalpine habitats, but commonest in montane coniferous forest. It is the first non-hibernator to appear in spring; on 27 V 77 a fresh male was taken flying over continuous snow cover at the LeRoy Mine. Variation in our series is minimal, and there is no trace of a second brood.

HOST PLANTS: Undetermined; *Ceanothus* spp. suspected.

RECORDS: Yellow Rose Mine Trail, 27 V 77; Lone Jack (4), 28 V 77; Crawford Creek (4), 29 V 77; Cecilville, 29 V 77; Boulder Creek (6), 12 VI 76; Lion Lake Trail, 13 VI 76; Union Creek (2) 14 VI 76; lower Coffee Creek, 14 VI 80; Eagle Creek, 14 VI 80; Deadfall Meadow, 15 VI 80; 3.2 km W Gazelle, 15 VI 80; 6.5 km W Callahan, 15 VI 80; Deer Creek (3), 16 VI 76, 27 VI 76; Willow Creek, 16 VI 76; Morris Meadow (2), 17 VI 76, 26 VI 76; Stuart Fork below Sawtooth Ridge, 24 VI 76; Swift Creek, 25 VI 77; Emerald Lake (2) 25 VI 76; Sapphire Lake, 25 VI 76; Coffee Creek, 26 VI 77; base of Red Rock Mountain, 10 VII 77; Grizzly Meadows (2), 19 VII 77; Mount Eddy, 6 VIII 78. (27 V - 6 VIII)

60. *Lycaeides argyrognomon* Berg complex. Anna Blue, Rice's Blue.

These populations are among our most complex and confusing. Several phenotypes and ecotypes occur in the Trinity-Eddy area. Most specimens are referable to ssp. *anna* Edwards, but some from bog meadows look very like *ricei* Cross. Distinct populations occur in two very different habitats: on bogs, seeps, and wet meadows around 1500 m, and in xeric open sites near to above tree line, some 1000 m higher. On the average, bog females have less orange above than subalpine ones, but a few bog females have no orange on the forewing at all. See also the next species.

HOST PLANTS: Leguminosae. Bog populations are *always* associated with *Lotus oblongifolius* (Benth.) Greene var. *nevadensis* (Gray) Munz. Subalpine populations, including the rather lower-altitude one at Gumboot Butte, are *always* associated with *Astragalus whitneyi* var. *siskiyouensis* (Rydb.) Barneby, a plant confined to ultrabasic soils (except on Packer's Peak). On 6 VIII 78 the subalpine population at 2650 m on Mount Eddy was more advanced than the meadow one at Deadfall Lakes, 450 m lower.

RECORDS: *Bog populations*: Morris Meadow, 17 VI 76, (6) 26 VI 76, (2) 4 VIII 79; Deer Creek, 27 VI 76; Mumford Meadow, 25 VI 77; Gibson Meadows (4) 30 VII 76; Morgan Meadows (10), 12 VII 79; Grizzly Meadows (2), 18 VII 77; Deadfall Lakes (7), 6 VIII 78, 16 VIII 79, 27 VIII 79, 16 IX 78; Dead Mule Camp (9), 5 IX 76; Parker Creek Trail, 6 IX 76. (17 VI - 16 IX) *Subalpine Populations*: Packer's Peak, 9 VII 77, (4) 15 VIII 77; Mount Eddy, near summit, (2) 6 VIII 78, 16 VIII 79; Gumboot Butte, 11 VIII 76. (9 VII - 16 VIII)

61. *Lycaeides melissa* Edwards. Melissa Blue.

Melissa is abundant in Scott Valley and along the Callahan - Gazelle Road, where it is a multiple-brooded pest of cultivated Alfalfa. It has also been collected at high elevations associated with *Astragalus whitneyi*, but the populations are not phenotypically differentiated and it is not clear whether or not *melissa* is a permanent resident in the high country. The subalpine *melissa* from the Trinity-Eddy area are different from the animal associated with the same legume around Sonora and Carson Passes in the central Sierra. (This animal has been variously identified as an *argyrognomon* and a *melissa*.)

HOST PLANTS: In Scott Valley, Alfalfa (*Medicago sativa* L.). At Packer's Peak and Gumboot Butte, apparently *Astragalus whitneyi* ssp. *siskiyouensis* (Rydb.) Barneby. RECORDS: *Multivoltine*: Scott Valley, 29 V 77, (2) 15 VI 80, (55) 21 IX 79; Callahan, 15 VI 80, (12) 16 VIII 77; 3.2 km W Gazelle (7), 5 VII 80; French Creek (Scott Valley) (2), 21 IX 79. *Univoltine*: Gumboot Butte, 11 VIII 76; Packer's Peak (2), 15 VIII 77; Deadfall Lakes (6), 20 IX 79.

62. *Plebeius saepiolus* Boisduval. Greenish Blue.

Abundant and general in meadows and bogs, from the upper foothills to near tree line. Apparently always univoltine, with red-brown females only. Trinity-Eddy specimens average larger than Sierran ones from the same elevations, and are more boldly marked beneath. Many Eddy-Deadfall females have a submarginal row of black dashes visible dorsally. The Greenish Blue often flies with the Gray Blue in bogs, and the two may be difficult to distinguish in flight. We have several times found *saepiolus* roosting head down on low plants in boggy meadows at daybreak, completely covered with frost.

HOST PLANTS: *Trifolium longipes* Nutt., *T. wormskjoldii* Lehm., and *T. productum* Greene (all from several stations).

RECORDS: Cecilville (2) 29 V 77; Mumford Meadow (2), 14 VI 76, (6) 25 VI 77; Eagle Creek, 14 VI 80; Deadfall Meadow, 15 VI 80, (28) 12 VII 79, (2) 16 VIII 79, 20 IX 79; Willow Creek, 16 VI 76; Morris Meadow (6), 17 VI 76, (3) 24 VI 76; Deer Creek (4) 27 VI 76; Coffee Creek, 26 VI 77; Gulick Creek (3) 10 VII 77; Scott Mountain Summit (2) 11 VII 77; Morgan Meadows (11), 12 VII 79; Grizzly Meadows (4), 19 VII 77; Gibson Meadows (2) 31 VII 76; Granite Lake, 31 VII 76; Mount Eddy (2), 6 VIII 78, 16 VIII 79; Deadfall Lakes (9), 6 VIII 78. (29 V - 20 IX)

63. *Plebeius icarioides* Boisduval. *Icarioides* Blue.

This is the commonest Blue in open montane coniferous forest; it also occurs at the edges of dry meadows, but ranges less widely than the Echo Blue and, except on Mount Eddy, rarely over 1850 m. It varies but little, averages more heavily marked beneath than Sierran *icarioides* from similar elevations, and in general resembles North Coast Range and Yolla Bolly series. We have not found any dwarfed high-altitude populations like the one on Goat Mountain in the Yolla Bollys. One brood, early - to midsummer.

HOST PLANTS: Leguminosae: *Lupinus albicaulis* Dougl. ex Hook. (Brown's Meadow, 10 VIII 76) (generally associated). Oviposited on an undetermined lupine, not in flower, on Mount Eddy. It is not known if this species uses *Lupinus croceus*, the host of *Satyrrium fuliginosum*, with which it is rarely sympatric.

RECORDS: Lone Jack, 28 V 77; Mumford Meadow (2), 14 VI 76, (8) 25 VI 77; Coffee Creek (2) 14 VI 80, 26 VI 77; Eagle Creek, 14 VI 80; Crawford Creek, 15 VI 80; Morris Meadow, 17 VI 76, 24 VI 76; Bridge Camp (4) 18 VI 76; Deer Creek (2) 27

VI 76; base of Red Rock Mountain (5), 10 VII 77; Yellow Rose Mine trail (2), 10 VII 77; Deadfall Lakes, 12 VII 79, (2) 8 VIII 78; Grizzly Meadows, 18 VII 77; Mount Eddy (4), 6 VIII 78; Brown's Meadow, 10 VIII 76; Packer's Peak trail (4), 15 VIII 77. (28 V - 15 VIII)

64. *Plebeius acmon* Westwood and Hewitson. Acmon Blue.

Common and general; a weedy species of open country, capable of turning up almost anywhere, even in the remotest valleys. We doubt that it overwinters above 1000 m in this region. Multiple brooded, with some seasonal variation, but usually easy to distinguish from *P. lupini*.

HOST PLANTS: Polygonaceae: *Eriogonum nudum* ssp. *sulphureum* (Greene) Stokes (Lone Jack and Hwy. 3); *E. umbellatum* Torr. (Canyon Creek and Packer's Peak). Leguminosae: *Lotus purshianus* (Benth.) Clem. and Clem. (Big Flat); *L. denticulatus* (Drew) Greene and *L. humistratus* Greene, many stations.

RECORDS: Lone Jack, 27 V 77; Canyon Creek, 28 V 77; Scott Valley, 29 V 77; Lion Lake Trail, 13 VI 76; Mumford Meadow (2), 14 VI 76; Coffee Creek, 800 m, (4) 14 VI 80; Eagle Creek, 14 VI 80; lower Bear Basin Meadow, 15 VI 76; Morris Meadow, 14 VI 76, 17 VI 76, 26 VI 76; Crawford Creek (3), 15 VI 80; Deadfall Meadow, 15 VI 80; Callahan, 15 VI 80; 6.5 km W Callahan, 15 VI 80; Willow Creek (?), 16 VI 76; Deer Creek (2) 16 VI 76, 27 VI 76; Cold Spring (2), 24 VI 76; Emerald Lake, 25 VI 76; Coffee Creek, 1400 m, (3) 26 VI 77; 3.2 km W Gazelle (2) 5 VII 80; Packer's Peak trail, 9 VII 77; Yellow Rose Mine Trail, 10 VII 77, 5 IX 76; Sunrise Pass (4), 10 VII 77; Deadfall Lakes (4) 8 VIII 78, (3) 16 IX 78; Carrville (2), 7 VIII 76; cirque above Josephine Lake, 8 VIII 76; Brown's Meadow, 10 VIII 76; Packer's Peak, 15 VIII 77; Douglas City, 29 VIII 79; Sunrise Creek (3), 5 IX 76; Union Creek Trail (2), 6 IX 76; Deadfall Meadow (3), 20 IX 79; Big Flat, 25 IX 77. (27 V - 25 IX)

65. *Plebeius lupini* Boisduval. Lupine Blue.

This mis-named Blue is common in the vicinity of its host - Sulphur Flower, *Eriogonum umbellatum* - from the foothills to the top of Mount Eddy. Unlike *P. acmon*, it is strictly univoltine, but the flight season is very long. Trinity-Eddy specimens are subtly different from Sierran ones in various color and pattern characters.

Throughout its great altitudinal range, *lupini*, like its host plant, prefers sandy or gravelly areas including talus slopes and mine tailings. It does not seem to colonize plants in seasonal streambeds subject to inundation. It strays to meadows and is occasionally taken on mud puddles.

HOST PLANTS: *Eriogonum umbellatum* Torr. complex (many stations).

RECORDS: Coffee Creek, 850 m, 27 V 77; Canyon Creek, 28 V 77; Lone Jack (3), 28 V 77, 18 VI 77; Eagle Creek (9), 14 VI 80; Crawford Creek (2), 15 VI 80; Mumford Meadow, 25 VI 77; Emerald Lake (3), 25 VI 76; Coffee Creek, 1400 m (2), 26 VI 77; Stuart Fork below Sawtooth Ridge (2), 24 VI 76, 5 VII 79; Morris Meadow (3), 26 VI 76; Sunrise Pass, 10 VII 77; Deadfall Lakes, 12 VII 79, 6 VIII 78, 20 IX 79; Grizzly Meadows (5), 19 VII 77; Granite Lake (3), 31 VII 76; Granite Creek (2), 30 VII 76; Mount Eddy, near summit (2), 6 VIII 78, fresh male 16 IX 78; Caribou Basin, 9 VIII 76. (27 V - 20 IX)

66. *Agriades glandon* Prunner. Gray Blue.

The name of our Gray Blue has bounced around in the literature. Determinations of conspecificity with Palaearctic taxa are shaky at best, and there are

probably two or three genetic species in North America. Whatever one calls it, the Gray Blue is a consistent inhabitant of *Darlingtonia* bogs in the Red Trinities and on Mount Eddy, flying with *Plebeius saepiolus*, *Thorybes mexicana aemilia*, *Chlosyne hoffmanni segregata*, and *Phyciodes campestris*. We have never found it on the small heather bogs on granite. It does occur in the Caribou Basin.

Trinity-Eddy populations are more boldly marked beneath than Sierran *podarce* Felder and Felder. They also average larger and broader-winged. Females vary from plain chestnut-brown above to conspicuously white-dotted on the disc. Similar forms occur in high-altitude *podarce*.

HOST PLANTS: Primulaceae: *Dodecatheon jeffreyi* Van Houtte (many stations). RECORDS: Eagle Creek, 14 VI 80; Deer Creek, 16 VI 76, (9) 27 VI 76; Mumford Meadow (11), 25 VI 77; Gulick Creek (4), 10 VII 77; Scott Mountain summit (7), 11 VII 77; Morgan Meadows (2), 12 VII 79; Deadfall Lakes (4), 12 VII 79, (2) 6 VIII 78, (12) 27 VIII 79; Mount Eddy (9), 6 VIII 78, (3) 16 VIII 79; Caribou Basin (6), 9 VIII 76; upper Caribou Lakes Trail, 1850 m, 10 VIII 76; Sunrise Creek, 5 IX 76. (14 VI - 5 IX)

67. *Everes amyntula* Boisduval. Western Tailed Blue.

Like the Anna Blue, this species occurs in different habitats on different Leguminous hosts. In the foothill canyons and lower montane coniferous forest it occurs in small clearings and along stream edges, with a small vetch; at mid-elevations, in successful thickets at the edges of meadows, often with Bracken, associated with a larger vetch; and near to above tree line it swarms over the common alpine locoweed. Alpine specimens average darker and duller than others, with larger black dots beneath.

The Western Tailed Blue is univoltine everywhere in our area, except possibly for the fresh male collected 20 IX 79 at Deadfall Meadow.

HOST PLANTS: Leguminosae: *Vicia californica* Greene (Crawford Creek); *Lathyrus jepsonii* ssp. *californicus* (Wats.) Hitchc. (Deer Creek); *Astragalus whitneyi* ssp. *siskiyouensis* (Rydb.) Barneby (Packer's Peak, Mount Eddy). Larvae feed on green seeds inside pods, sealing up the entrance hole with silk.

RECORDS: Lone Jack, 28 V 77; Shadow Creek (2), 29 V 77; Crawford Creek (4), 29 V 77, (2) 15 VI 80; Canyon Creek (5), 28 V 77; Stuart Fork below Sawtooth Ridge (4), 24 VI 76; Deer Creek (6), 27 VI 76; Packer's Peak, near summit (5), 9 VII 77; Morgan Meadows, 12 VII 79; Deadfall Lakes (3), 12 VII 79, (5) 6 VIII 78, 27 VIII 79; Mount Eddy, summit area and south arm (28), 6 VIII 78; Deadfall Meadow, 20 IX 79. (28 V - 20 IX)

PIERIDAE

68. *Colias philodice eriphyle* Edwards. Yellow Sulphur.

Common in Alfalfa fields, Scott Valley and Callahan - Gazelle Road, with the Melissa Blue. This sulphur apparently strays south along Highway 3 to south of Weaverville, and breeds sporadically and unreliably in the Trinities. It cannot be considered a permanent resident there. Hybrids with *C. eurytheme* have been found at Callahan. Three broods, the late fall specimens heavily melanized below and vaguely whitish above ("*anthyle*").

HOST PLANTS: Leguminosae: Alfalfa (*Medicago sativa* L.), probably others.

RECORDS: 3.2 km W Gazelle (5), 15 VI 80, (20) 5 VII 80; Callahan (8), 16 VIII 77; French Creek (Scott Valley) (3), 21 IX 79; Gazelle, 3 IX 77; Parker Meadow, fresh

male, 1 X 76; Douglas City, female, 2 X 76. Hybrids: 3.2 km W Gazelle (4), 5 VII 80; Callahan (2), 16 VIII 77. (15 VI - 2 X)

69. *Colias eurytheme* Boisduval. Orange Sulphur.

Common everywhere, from the foothills to above tree line. Females run 40-50% white. We suspect that *C. eurytheme* does not overwinter above 1000 m in the Trinity-Eddy area, since all the high-elevation records for June are of second-generation phenotypes which could not be from overwintered larvae. We also doubt that it overwinters reliably in Scott Valley. One *semialba* female, Union Creek, 6 IX 76.

HOST PLANTS: Leguminosae: *Trifolium longipes* Nutt., *wormskjoldii* Lehm., *pratense* L., all oviposition records at Morris Meadow, VI 1976; *Medicago sativa* L., Scott Valley; probably others.

RECORDS: Coffee Creek, 850 m, 27 V 77, 14 VI 80; Lone Jack, 28 V 77; Lion Lake trail, 13 VI 76; Parker Meadow (3), 14 VI 76; Eagle Creek (2), 14 VI 80; Mumford Meadow (2), 14 VI 76, (4) 25 VI 77; ridge between Bear and Black Basins (2), 15 VI 76; Crawford Creek, 15 VI 80; Deadfall Meadow, 15 VI 80; road 42N17, 1.1 km N Deadfall Meadow, 15 VI 80; 11 km E Callahan, 15 VI 80; Willow Creek (3), 16 VI 76; Morris Meadow (3), 17 VI 76, 24 VI 76, 26 VI 76; Union Creek (2), 14 VI 76, (4) 6 IX 76; Coffee Creek, 1400 m, 26 VI 77; 3.2 km W Gazelle (6), 5 VII 80; Packer's Peak, 9 VII 77; base of Red Rock Mountain (5), 10 VII 77; Morgan Meadows, 12 VII 79; Deadfall Lakes, 12 VII 79, 6 VIII 78, 16 VIII 79, (8) 16 IX 73, 20 IX 79; Grizzly Meadows, 19 VII 77; Granite Creek, 30 VII 76; Granite Lake, 31 VII 76; Mount Eddy, 6 VIII 78; Yellow Rose Mine Trail, 5 IX 76; Dead Mule Camp (3), 5 IX 76; French Creek (Scott Valley) (3) 21 IX 79; Big Flat, 24 IX 77; Swift Creek, 1 X 76; Douglas City, 2 X 76. (27 V - 2 X)

70. *Colias occidentalis chrysomelas* H. Edwards. Golden Sulphur.

Our only Sulphur of the forest; never seen in meadows. Frequent in lower montane coniferous forest among Yellow Pine and Douglas Fir, often occurring with *Anthocharis lanceolata*, *Pieris napi*, *Carterocephalus palaemon*, and *Plebeius icarioides*. No truly white females have been collected, but we have a "whitish" one from Hobo Gulch. One brood.

HOST PLANTS: Leguminosae: Associated with *Lupinus albicaulis* Dougl. ex Hook. and *Lathyrus pauciflorus* Fern. ssp. *browni* (Eastw.) Piper.

RECORDS: Lone Jack (4), 18 VI 77; Hobo Gulch (6), 18 VII 77; Crawford Creek (S.O.M.). (18 VI - 18 VII)

71. *Neophasia menapia* Felder and Felder. Pine White.

The Pine White is abundant from the foothill canyons to above 6000 feet, usually in clearings, along trails, or at the edges of meadows within montane coniferous forest. Deep in the forest, individuals may be seen 30 or 40 feet off the ground. Visits *Aster*, *Chrysothamnus*, and *Haplopappus bloomeri* freely.

Trinity-Eddy specimens are rarely heavily enough marked to match the description of Coast Range *tau* Scudder; most would fit within the variational range of Sierran material.

At 900 m this species flies in late June and July, while at 1500 m it is not seen until early September and then flies into October. This is *not* a steady progression in emergence dates as one moves upslope; there seems to be a sharp phenological discontinuity. The same phenomenon occurs between 1500 and 2100 m in Nevada County, on the Sierran west slope. Emmel and Shields recorded the

Pine White at 1900 m, high on the Caribou Lakes Trail, 20 VII 68. We have never seen it at this elevation until a full month or more later. It was not present on this trail on 10 VIII 76 and was not seen 400 m lower at Big Flat for almost a month.

HOST PLANTS: Not determined here; presumably Pinaceae.

RECORDS: Trinity Summit, 1100 m (3), 9 VII 77; Hobo Gulch (4), 18 VII 77; Deer Creek, 5 VIII 79; Packer's Peak Trail, 1750 m, 15 VIII 77; Papoose Lake turnout, 27 VIII 76; Bob's Farm, 27 VIII 76; Sunrise Creek, 5 IX 76; Big Flat (5), 7 IX 76, (3) 8 IX 76, (6) 30 IX 76; Yellow Rose Mine Trail (5), 7 IX 76; below Deadfall Meadow, 16 IX 78; Swift Creek (13), 1 X 76. (9 VII - 1 X)

(71A. *Pieris beckerii* Edwards. Becker's White.

Not recorded in the Trinities or on Mount Eddy, but apparently resident in Scott Valley and as far west as Callahan; therefore to be expected as a stray.

HOST PLANTS: Undetermined locally.

RECORDS: 3.2 km W Gazelle (2), 15 VI 80; Callahan, 16 VIII 77; Scott Valley, 21 IX 79.)

72. *Pieris sisymbrii* Boisduval. California White.

This is a common species in the high country of both the granite and ultra-basic Trinities. It has been recorded hilltopping on ridges and summits from 1800 to 2700+ m. Females occasionally turn up in creek bottoms at lower elevations. Mount Eddy material averages larger than Trinity. All specimens are very heavily marked; females run 50% white, 50% yellow. Strictly univoltine.

HOST PLANTS: Undetermined in the Trinities; probably *Streptanthus*, *Arabis*, or *Draba* species, never found with weedy, introduced Crucifers. On Mount Eddy on the endemic semi-succulent Crucifer *Streptanthus barbatus* Wats.

RECORDS: Lion Lake Trail, 13 VI 76; between Lion Lake and Foster Lake, 13 VI 76; ridge between Bear and Black Basins (3), 15 VI 76; road 42N17, 1.1 km N Deadfall Meadow, flying over snow, 15 VI 80; Coffee Creek, 1400 m, 26 VI 77; Deer Creek, 27 VI 76; Deadfall Lakes (4), 12 VII 79; Mount Eddy summit (3), 6 VIII 78. (13 VI - 6 VIII)

73. *Pieris protodice* Boisduval and LeConte. Checkered White.

Probably not a regular resident. This lowland species had a "boom" year in 1977 and spread very widely in northern California, but subsequently disappeared from almost all of this extended range. It was not found in the study area in 1976, 1978 or 1979. Its nearest "permanent" populations are at the head of the Central Valley at Turtle Bay, Redding.

HOST PLANTS: Oviposition seen on *Rorippa curvisiliqua* (Hook.) Bessey in a dry stream bed, Mumford Meadow, 25 VI 77.

RECORDS: Mumford Meadow (5), 25 VI 77; Coffee Creek, 1400 m, 26 VI 77; Hwy. 3 at Swift Creek (8), 10 VII 77; Packer's Peak (9), 15 VIII 77; Big Flat, 25 IX 77. (25 VI - 25 IX)

74. *Pieris occidentalis* Reakirt. Western White.

The Western White is the only butterfly that rivals the Western Tailed Blue in abundance at 2700 m. It occurs from 1500 m to the highest summits, but breeds at 850 m on the floor of Scott Valley where *P. protodice* seems not to occur. There is tremendous individual variation. A few extreme *calyce* Edwards have been taken, mostly on Mount Eddy. This is a phenotype induced by short days and pupal chilling after diapause. Of about 203 specimens, only 27 are females; this reflects

the hilltopping behavior of the males, rendering them much easier to find.

It is not unusual to find 3 or 4 species of white Pierids, plus *Parnassius phoebus sternitzkyi*, hilltopping on the same summit; usually at least 75% of the specimens will be *P. occidentalis*. At least partially double-brooded; perhaps partially triple-brooded in Scott Valley.

HOST PLANTS: Ovipositions have been seen on the following Crucifers: *Descurainia richardsonii* ssp. *viscosa* (Rydb.) Detl.; *Draba howellii* Wats.; *D. crassifolia* Grah.; *Athysanus pusillus* (Hook.) Greene; *Arabis platysperma* Gray; *A. breweri* Wats.; *Lepidium campestre* (L.) R.Br.; *Pheonicaulis cheiranthoides* Nutt. in T. & G.; *Streptanthus tortuosus* Kell.; *S. barbatus* Wats. Probably others will be found.

RECORDS: 11 km E Callahan, 15 VI 80; 6.5 km W Callahan, 15 VI 80; 3.2 km W Gazelle (2), 15 VI 80; Callahan, 15 VI 80; Packer's Peak (4), 9 VII 77, (39) 15 VIII 77, 30 IX 76; Sunrise Pass and Red Rock Mountain (20), 10 VII 77, (8) 5 IX 76; Deadfall Lakes (6), 12 VII 79, (3) 16 VIII 79, (7) 16 IX 78; Grizzly Meadows, 19 VII 77; Mount Eddy, mostly near summit (93), 6 VIII 78, (10) 16 IX 78; Parker Creek divide (8), 6 IX 76; Dead Mule Camp (7), 5 IX 76; Dorleska Summit (2), 7 IX 76; Callahan (3), 21 IX 79; French Creek (Scott Valley) (3), 21 IX 79; Big Flat, 25 IX 77. (15 VI - 30 IX) 75.

Pieris napi Linnaeus. Gray-Veined White.

Frequent in montane coniferous forest, mostly below 2100 m. Occurs mainly in moist canyon bottoms. Trinity *napi* are smaller and more lightly marked than typical *microstriata* Comstock, showing some resemblance to *marginalis* Scudder of western Oregon, and also to the unnamed Warner Mountains population which, however, is multivoltine and lives in boggy meadows. These are strictly univoltine and monophenic in the wild, but we have reared a brood of 16 nearly immaculate second-brood specimens from laboratory, non-diapause pupae (eclosed late VI - early VIII, 1977; Shadow Creek stock on *Brassica campestris* L.).

No *napi* have been recorded from Mount Eddy.

Often found flying with *Anthocharis lanceolata*, only infrequently at flowers. Difficult to collect because males, in particular, fly 20 feet or more off the ground.

HOST PLANTS: The following Crucifers are common in *napi* habitats. No definite hosts have been recorded: *Dentaria californica* Nutt. and var. *cardiophylla* (Greene) Detl.; *Cardamine breweri* Wats.; *C. lyallii* Wats.; *Thlaspi glaucum* Nels. var. *hesperium* Pays.

RECORDS: Canyon Creek (2), 28 V 77; Cecilville (2), 29 V 77; Crawford Creek (5), 29 V 77; Shadow Creek, 29 V 77; Parker Meadow, 14 VI 76; Coffee Creek, 800 m (2), 14 VI 80; 11 km E Callahan, 15 VI 80; Callahan, 15 VI 80; Deer Creek, 15 VI 76, 16 VI 76, (2) 27 VI 76; Willow Creek, 16 VI 76; Lone Jack, 18 VI 77; Stuart Fork below Sawtooth Ridge, 25 VI 76; Coffee Creek, 1400 m, 26 VI 77. (28 V - 27 VI) 76.

Pieris rapae Linnaeus. European Cabbage Butterfly.

Occasional. Not very common, perhaps resident only at lower levels. It definitely overwinters in Scott Valley and at Cecilville, but June-July specimens at higher elevations are second-brood flyups from the Central Valley (?). Meadows, and along trails and streams.

HOST PLANTS: Not recorded in the Trinities; presumably Cruciferae.

RECORDS: Scott Valley, 29 V 77, 21 IX 79; Crawford Creek, 29 V 77; Shadow Creek, 29 V 77; Cecilville, 29 V 77; Coffee Creek, 800 m, 14 VI 80; Callahan, 15 VI

80; Morris Meadow, 24 VI 76; Coffee Creek, 1400 m, (2) 26 VI 77; Swift Creek, 25 VI 77; Packer's Peak trail, 9 VII 77, (2) 15 VIII 77; Deadfall Lakes (2), 6 VIII 78, (2) 16 IX 78; Big Flat, 7 IX 76; French Creek (Scott Valley), 21 IX 79; Etna, 21 IX 79. (29 V - 21 IX)

77. *Anthocharis sara* Lucas. Sara Orange - Tip.

Infrequent, recorded in foothill and lower montane canyons in the Trinities, thus far not on Mount Eddy; almost all four specimens are males, and all are white. There is no trace of yellow ground-color characteristic of high-elevation and east-slope Sierran populations, and the white *sara* do not expand into their niche. Single-brooded.

HOST PLANTS: Undetermined, presumably Crucifers.

RECORDS: Coffee Creek, 850 m (4), 27 V 77; Canyon Creek, 28 V 77; Lone Jack, 28 V 77; Crawford Creek, 29 V 77; Scott Valley, 29 V 77; Shadow Creek, 29 V 77; 6 km W Callahan, 15 VI 80; Deer Creek, 27 VI 76. (27 V - 27 VI)

78. *Anthocharis lanceolata* Lucas. Boisduval's Marble.

Usually a scarce butterfly, Boisduval's Marble is common everywhere in the Trinities that *Pieris napi* occurs, and ranges higher in the same canyons. Like that species, it is not yet recorded from Mount Eddy. Our specimens vary in size but average smaller than Sierran ones; there seem to be no phenotypic distinctions among Coast Range, Trinity, and Sierra *lanceolata*. The butterfly rarely visits flowers, and is difficult to catch.

HOST PLANTS: Ovipositions as follows: *Arabis holboellii* Horn. var. *retrofracta* (Grah.) Rydb. (Deer Creek, 27 VI 76); *A. glabra* (L.) Bernh. (Lone Jack, 28 V 77). Probably other Crucifers as well.

RECORDS: Lone Jack, 28 V 77; Canyon Creek (2), 28 V 77; Scott Valley, 29 V 77; Cecilville (3), 29 V 77; Coffee Creek, 800 m, 14 VI 80; 6.5 km W Callahan (4), 15 VI 80; Deer Creek (4), 27 VI 76; Coffee Creek, 1400 m, 7 VII 77; Packer's Peak Trail, 9 VII 77. (28 V - 9 VII)

79. *Euchloe ausonides* Lucas. Large Marble.

Here again, there are high- and mid-altitude populations differing in ecology and phenotype. Above 1500 m occurs the small, Sierran - type "alpine *ausonides*" - a hilltopper usually found coursing over bare rock at or near summits. In lower habitats occurs a larger *ausonides* similar to that found in the Central Valley. Near Gazelle this animal is double-brooded. The entire complex requires further study.

HOST PLANTS: *Descurainia* sp. (Deadfall Lakes, a dead specimen damaged in *ausonides* fashion, 16 VIII 79; one larva, 3.2 km W Gazelle, 5 VII 80); *Lepidium* sp. (Scott Valley, 14 VI 80). Probably a variety of Crucifers.

RECORDS: Coffee Creek, 850 m (7), 27 V 77; 11 km E Callahan, 15 VI 80; Callahan, 15 VI 80; 6.5 km W Callahan (3), 15 VI 80; Mumford Meadow, 25 VI 77; Deadfall Lakes, 12 VII 79; Grizzly Meadows, 19 VII 77; Caribou Basin, 21-22 VII 68 (Emmel and Shields, not found by us). Second brood: 3.2 km W Gazelle (6), 5 VII 80. (27 V - 22 VII)

80. *Euchloe hyantis* Edwards. Edwards' Marble.

Commoner and more general than the preceding; foothills to above tree line, but usually found hilltopping on high, bleak ridges with *Pieris occidentalis* and *P. sisymbrii*. Males also patrol vertical rock faces at canyon bottoms. There are no

phenotypic differences from Sierran specimens, and the large, bright phenotype found in foothill canyons in the Coast Ranges has not been observed in our area. **HOST PLANTS:** Probably among *Streptanthus*, *Arabis*, and *Draba* (Cruciferae). **RECORDS:** Coffee Creek, 850 m, (4), 27 V 77; Lone Jack, 28 V 77; Scott Valley, 29 V 77; ridge above Deer Creek, 15 VI 76; 6.5 km W Callahan (3), 15 VI 80; Sapphire Lake (2), 25 VI 76; Mumford Meadow, 25 VI 77; Morris Meadow, 26 VI 76; Packer's Peak, 9 VII 77; Deadfall Lakes, 12 VII 79; Mount Eddy summit (4), 6 VIII 78. (27 V - 6 VIII)

PAPILIONIDAE

81. *Papilio zelicaon* Lucas. Anise Swallowtail.

Very common and widespread from the foothills to the alpine zone, mostly seen as a hilltopper. Probably partially double-brooded, at least at low elevations. The interpretation of the long flight season is confounded by vertical movements. There is considerable individual variation; a few specimens have an orange flush below, and the Emerald Lake female has it above as well. Visits *Monardella* and other butterfly flowers.

HOST PLANTS: Umbelliferae: *Angelica arguta* Nutt. ex T. & G. (numerous stations, eggs and larvae; the commonest large Umbellifer in the Trinities).

RECORDS: Coffee Creek (5), 27 V 77, 26 VI 77; Scorpion Creek, 28 V 77; Parker Meadow, 14 VI 76; Union Creek, 14 VI 76; Scott Valley (2), 15 VI 80; 11 km E Callahan, 15 VI 80; Emerald Lake (2), 25 VI 76; Mumford Meadow, 25 VI 77; 3.2 km W Gazelle, 5 VII 80; Sunrise Pass (9), 10 VII 77, 5 IX 76; base of Red Rock Mountain, 10 VII 77; Deadfall Lakes, 12 VII 79, 16 IX 78; Grizzly Meadows, 19 VII 77; Mount Eddy summit area (26), 6 VIII 78, (2) 16 IX 78; Packer's Peak summit (7), 15 VIII 77. (27 V - 16 IX)

82. *Papilio indra* Reakirt. Indra Swallowtail.

Occasional over a wide elevational range, but never common anywhere. We have six specimens - four from mud puddles and two hilltopping. When *P. indra* "hilltops" it typically flies just below the crest, rarely mixing with *P. zelicaon* at the top. This habit makes it easy to overlook, and difficult to catch even if seen. Phenotypically these are like northern Sierran *indra*, not like the phenotype that occurs on serpentine in the North Coast Range.

HOST PLANTS: Undetermined; probably Umbelliferae.

RECORDS: Lone Jack, 28 V 77; Crawford Creek, 15 VI 80; Morris Meadow (2), 26 VI 76; Mount Eddy, summit area (2), 6 VIII 78. (28 V - 6 VIII)

83. *Papilio rutulus* Lucas. Western Tiger Swallowtail.

Widespread, but not very common. Single-brooded with a long flight season. The Western Tiger Swallowtail occurs primarily along creek bottoms within montane coniferous forest, flying far off the ground but dipping down to visit flowers of *Lilium washingtonianum*, *Rhododendron*, *Cirsium*, or *Monardella*.

HOST PLANTS: Not known locally.

RECORDS: Canyon Creek, 28 V 77; Scott Valley, 29 V 77; Boulder Creek, 12 VI 76; lower Coffee Creek Canyon, vic. Ranger Station (2), 14 VI 80; Crawford Creek, 15 VI 80; Willow Creek, 16 VI 76; Lone Jack, 18 VI 77; Bridge Camp, 23 VI 76; Mumford Meadow, 25 VI 77; Morris Meadow, 26 VI 76, 4 VIII 79; Yellow Rose Mine Trail, 10 VII 77; Packer's Peak Trail (aberrant), 15 VIII 77. (28 V - 15 VIII)

84. *Papilio multicaudatus* Kirby. Two - Tailed Swallowtail.

We have only two definite records, both at low elevation. These scanty data suggest that *P. multicaudatus* is a bivoltine, foothill species in this area - a picture consistent with other northern California records. However, Emmel and Shields recorded it at mid-elevation in late July, between the foothill dates.

HOST PLANTS: Not known locally.

RECORDS: Scott Valley, 29 V 77; Carrville, 7 VIII 76; recorded by Emmel and Shields from below Brown's Meadow, 20 VII 68.

85. *Papilio eurymedon* Lucas. Pale Swallowtail.

This is a very common and widespread Swallowtail, overall only slightly less numerous than *P. zelicaon*. It is much less regular as a hilltopper than that species. It occurs mostly in canyon bottoms, patrolling along watercourses, or along trails in montane coniferous forest where it may suddenly appear from among the trees. It visits *Vicia*, *Monardella*, and *Lilium washingtonianum* flowers avidly. Males also frequent puddles and streambanks. There is only one brood, with a very long flight season.

HOST PLANTS: Not determined, but presumably Rhamnaceae.

RECORDS: Canyon Creek (3), 28 V 77; Cecilville, 29 V 77; Crawford Creek (3), 29 V 77, 15 VI 80; Scott Valley, 29 V 77; Eouler Creek (2), 12 VI 76; 6.5 km W Callahan, 15 VI 80; Willow Creek, 16 VI 76; Morris Meadow, 17 VI 76, (2) 26 VI 76; Lone Jack, 18 VI 77; Emerald Lake, 25 VI 76; Coffee Creek, 26 VI 76; Mumford Meadow, 25 VI 77; Hobo Gulch, 18 VII 77; Caribou Lakes trail (2), 10 VIII 76; Union Creek, 6 IX 76. (28 V - 6 IX)

86. *Parnassius clodius* Menetries. Clodius.

Common and widespread. In the lower montane coniferous forest this species is large in size and co-occurs with *Papilio eurymedon*, *Everes amyntula*, *Phyciodes orseis*, *Colias occidentalis*, *Pieris napi*, etc. along trails and streams. Above 1800 m it is much smaller and occurs in meadows and bogs, where it has a different host. The same sort of variation occurs on the Sierran west slope.

The only virgin female we have seen was taken fresh on 20 September 1979 at Deadfall Lakes, long after the main flight. Presumably there were no males available by then.

HOST PLANTS: Fumariaceae: *Dicentra formosa* (Andr.) Walp. (Crawford Creek); *D. pauciflora* Wats. (Gulick Creek and Mount Eddy).

RECORDS: Crawford Creek, 29 V 77, (3) 15 VI 80; Cecilville (2), 29 V 77; Boulder Creek, 12 VI 76; Mumford Meadow, 14 VI 76, (6) 25 VI 77; Coffee Creek, 800 m (2) 15 VI 80, 1400 m, 26 VI 77; Willow Creek (2), 16 VI 76 (one aberrant, lacks red color); Stuart Fork, 24 VI 76; Morris Meadow, 26 VI 76; Deer Creek (2), 27 VI 76; base of Red Rock Mountain (6), 10 VII 77, 5 IX 76; Gulick Creek, 10 VII 77; Deadfall Lakes (7), 12 VII 79, 6 VIII 78, 16 VIII 79, 20 IX 79; Morgan Meadows (2), 12 VII 79; Grizzly Meadows, 19 VII 77; Gibson Meadows (2) 30 VII 76; Granite Lake, 31 VII 76; Mount Eddy (10), 6 VIII 78; cirque above Josephine Lake, 8 VIII 76; Caribou Basin (3), 9 VIII 76; Brown's Meadow (3), 10 VIII 76; Dorleska Mine, 7 IX 76. (29 V - 20 IX)

87. *Parnassius phoebus sternitzkyi* McDunnough. Sternitzky's Parnassian.

Common, mostly in subalpine and alpine habitats, on sparsely vegetated rocky terrain. This is a hilltopping species, unlike *P. clodius*, and can be very difficult to net on the steep, jagged slopes of the high granite country. In the Caribou Basin it

courses over the meadows at the foot of the cliffs. Both sexes visit flowers, especially *Monardella*, and both often bask with wings spread in cool or partly cloudy weather.

There is extensive minor variation.

HOST PLANTS: Crassulaceae: *Sedum obtusatum* Gray ssp. *boreale* Clausen. This plant grows on both granite and ultrabasics and is one of the most characteristic subalpine and alpine plants in the Trinities and Eddies.

RECORDS: Sapphire Lake (2), 25 VI 76; Emerald Lake, 25 VI 76; Granite Lake, 30 VII 76, (5) 31 VII 76; ridge between Deer Creek and Bear Basin, 31 VII 76; Mount Eddy summit area (5), 6 VIII 78, (2) 16 VIII 79, (4) 27 VIII 79, 16 IX 78; Caribou Basin (7), 9 VIII 76; cirque above Josephine Lake, 8 VIII 76; crest of Sawtooth Ridge, 8 VIII 76; Gumboot Butte, 11 VIII 76; Packer's Peak summit, 15 VIII 77; Mirror Lake, 27 VIII 76; Dorleska Summit, 7 IX 76. (25 VI - 16 IX)

HESPERIIDAE

88. *Amblyscirtes vialis* Edwards. Roadside Skipper.

This inconspicuous little skipper occurs in grassy streambank vegetation at mid-elevations in cool canyons, often with *Carterocephalus palaemon*. It may be more widespread than our records indicate.

HOST PLANTS: Presumably Gramineae.

RECORDS: Coffee Creek, 800 m, (3) 14 VI 80; Crawford Creek, 15 VI 80; Stuart Fork below Sawtooth Ridge, 24 VI 76; Coffee Creek, 1400 m, 26 VI 77. (14 VI - 26 VI)

88A. *Euphyes vestris* Boisduval. Dun Skipper.

To our surprise, one fresh female was taken among many *Polites sonora* on the bog at Scott Mountain Summit, 27 VII 80, visiting *Prunella*. The nearest known colonies are in the Hambone-Bartle area and at Mount Shasta City (26 VII 80). It occurs on the west slope of the Coast Ranges in Sonoma and Mendocino Counties.

89. *Paratrytone melane* Edwards. Umber Skipper.

We have two foothill - canyon records. The Trinity-Eddy region is near the northern limit of this species, which is double-brooded throughout its range. The second brood flies several weeks earlier at Sacramento than our Douglas City record.

HOST PLANTS: Unknown.

RECORDS: Coffee Creek, 850 m 27 V 77; Douglas City, 2 X 76.

90. *Ochlodes sylvanoides* Boisduval. Woodland Skipper.

The Woodland Skipper is common in late summer and fall, but it never reaches the enormous abundance often seen at mid-elevations in the western Sierra. Phenotypically our insects resemble North Coast Range ones, but there is extensive variation. High-elevation males are paler and begin to look like Sierran east-slope ones. Visits fall Composites freely. The Woodland Skipper is the commonest butterfly on Rabbitbrush in September in Scott Valley and on the north slope of Mount Shasta.

HOST PLANTS: Presumably Gramineae.

RECORDS: Emerald Lake, 5 VIII 79; Stuart Fork below Sawtooth Ridge (3), 5 VIII 79; Bridge Creek (4), 6 VIII 79; Carrville (3), 7 VIII 76; Packer's Peak (13), 15 VIII 77; Douglas City (12), 29 VIII 79, 2 X 76; Yellow Rose Mine Trail (7), 5 IX 76; Union

Creek Trail (11), 6 IX 76; Dorleska Mine (4), 7 IX 76; Big Flat (15) 7 IX 76, (5) 8 IX 76, (3) 24 IX 77; Deadfall Lakes (17), 16 IX 78, (6) 20 IX 79; Callahan (3) 21 IX 79, 25 IX 77; French Creek (Scott Valley) (6) 21 IX 79; Gazelle (2), 25 IX 77. (5 VIII - 2 X)

91. *Ochlodes agricola* Boisduval. The Farmer.

Two foothill records of a species near its northern limit. Its range largely matches that of California Buckeye, its principal nectar source. Occurs in riparian canyon habitat.

HOST PLANTS: Undetermined.

RECORDS: Lone Jack, 18 VI 77; Hobo Gulch, 18 VII 77.

92. *Atalopedes campestris* Boisduval. The Sachem.

A low-elevation species recorded once as a stray in the Trinities. It also occurs abundantly in autumn in Scott Valley, visiting *Chrysothamnus* flowers. Dornfeld (1980) says it invaded much of Oregon since 1967 and is now firmly established there.

HOST PLANTS: Undetermined; presumably Gramineae.

RECORDS: Callahan (17), 21 IX 79; French Creek (Scott Valley), 21 IX 79; Big Flat, 30 IX 76.

93. *Hesperia juba* Scudder. Yuba Skipper.

Very common in late summer and fall; much less common in spring. As in the Sierra Nevada, spring specimens are usually worn - suggesting that this species, uniquely among American skippers, may hibernate as an adult.

The Yuba Skipper swarms over *Haplopappus bloomeri* and *Chrysothamnus* flowers in September. It is especially numerous on serpentine talus country and in Scott Valley. There is a great deal of minor individual variation.

HOST PLANTS: Presumably Gramineae.

RECORDS: Coffee Creek Canyon, 850 m, 27 V 77; Lone Jack, 28 V 77; Emerald Lake, 25 VI 76; Scott Valley (2), 15 VI 80; Packer's Peak (2), 15 VIII 77; Gulick Creek (5), 5 IX 76; Red Rock Mountain (2), 5 IX 76; Dead Mule Camp (4) 5 IX 76; Union Creek trail (15), 6 IX 76; Dorleska Mine (7), 7 IX 76; slope above Big Flat (4) 7 IX 76; Big Flat (3) 8 IX 76, 25 IX 77; Mount Eddy (2), 16 IX 78; Deadfall Lakes (5), 20 IX 79; Callahan (8), 21 IX 79; French Creek (Scott Valley) (2) 21 IX 79; Douglas City, 2 X 76. (27 V - 25 VI and 15 VIII - 2 X)

94. *Hesperia harpalus* Edwards complex. Harpalus Skipper.

Here belong some of our biggest problems in the Trinity-Eddy fauna. The complex as a whole is common and widespread, but comprises a bewildering array of phenotypically distinctive populations disposed along both elevational and directional gradients.

On the southern and southeastern foothill flank occur almost unmarked Coast Range types (*tildeni* Freeman). Around Mount Shasta City the males are slightly more heavily marked, the females much more so. At high elevations throughout, heavily marked populations with the *oregonia* Edwards pattern in both sexes are found. These descend to the northern foothills (Cecilville) and as close to Mount Shasta City as Morgan Meadows on the southeast side of Mount Eddy. On the north slope of Mount Shasta (Hwy. 97 and Military Pass Road) occur extremely light "desert" *oregonia*. Two similar specimens have been taken among many dark

oregonia at Deadfall Lakes. Scott Valley *oregonia* are almost as dark as high-elevation ones.

Males of the high-elevation populations are often taken at puddles. Both sexes frequent Rabbitbrush, *Haplopappus*, and *Aster* flowers. Despite the wide spread of dates, there is no evidence of more than one brood anywhere in the area. HOST PLANTS: Not determined, presumably Gramineae.

RECORDS: *tildeni* phenotypes: Carrville, 730 m (7) 7 VIII 76; Douglas City (4), 29 VIII 79. Light *oregonia*: Mt. Shasta City (4) 31 VIII 77; Schoolhouse Hill, 2 IX 77. Desert (very light) *oregonia*: Military Pass Road (2), 16 VIII 79; Barnes Ranch (Scott Valley), 2 IX 77; Deadfall Lakes (2), 20 IX 79. Dark *oregonia*: Morgan Meadows (10), 12 VII 79; Granite Creek, 30 VII 76; Deadfall Lakes (5) 6 VIII 78, 16 VIII 79, (10) 20 IX 79; Bridge Creek (2) 6 VIII 79; Packer's Peak, 15 VIII 77; Little Castle Lake (2), 22 VIII 77; Parker Creek Divide, 6 IX 76; above Big Flat, 7 IX 76; Big Flat (5), 8 IX 76, 25 IX 77, 30 IX 76; French Creek (Scott Valley) (6) 21 IX 79; Callahan (8), 21 IX 79, (3) 25 IX 77. (12 VII - 30 IX)

95. *Hesperia columbia* Scudder. Columbia Skipper.

Uncommon in the Trinities and Eddies, but fairly frequent in fall in Scott Valley at *Chrysothamnus* with the other *Hesperia*. Apparently double-brooded. Farther south this species is usually associated with foothill chaparral, but we have two records in montane coniferous forest, one on serpentine talus, and a batch from agricultural land (Scott Valley).

HOST PLANTS: Undetermined.

RECORDS: Shadow Creek, 29 V 77; Deer Creek, 27 VI 76; Deadfall Lakes, 20 IX 79; Callahan (4) 21 IX 79; French Creek (Scott Valley) (2), 21 IX 79.

96. *Hesperia lindseyi* Holland. Lindsey's Skipper.

Common from Cecilville to Gazelle, mostly males at mud. Some specimens have little yellow scaling along the veins and are very similar to *harpalus*. Their spots are yellower (males), and the early flight season is distinctive. One record also from the south slope.

HOST PLANTS: Unknown.

RECORDS: Lone Jack, 28 V 77; Cecilville, 29 V 77; Crawford Creek (4), 15 VI 80; 11 km E Callahan (8), 15 VI 80; Scott Valley, 15 VI 80; Callahan, 15 VI 80; 6.5 km W Callahan (6), 15 VI 80; 3.2 km W Gazelle, 5 VII 80. (28 V - 5 VII)

97. *Polites sabuleti* Boisduval. Sandhill Skipper.

The Trinity-Eddy populations of the Sandhill Skipper represent a very distinctive, undescribed subspecies which may be characterized as follows: size as large as summer *s. sabuleti* from the Central Valley, never reduced as in *s. tecumseh* Grinnell; ventral hind wing pattern similar to *tecumseh* (males) or darker (females; often with light spots reduced to a curved band and a basal spot on a chocolate ground, resembling *Hesperia harpalus*); strictly univoltine, flying only in autumn. This entity is distributed as follows: an isolated colony at Plaskett Meadows, Glenn County (20 collected, 3 IX 76); Trinity-Eddy area at about 1500 m, east to Little Castle Meadow. On the north slope of Mount Shasta univoltine but paler and flying earlier (mid August); at Mount Shasta City possibly intergrading to *P. s. sabuleti* and perhaps bivoltine.

"Trinity" *sabuleti* occurs in dry meadows, serpentine barrens, brushy hillsides, and dry creek bottoms. It is probably the commonest butterfly of the

region, outnumbering all other butterflies combined during its flight season. It swarms over flowering *Chrysothamnus* and *Haplopappus* in the company of *Hesperia juba* and *H. harpalus* and *Ochlodes sylvanoides*, creating a confusing whirl of small yellow skippers. Perching males are highly territorial, but aggression is suspended at flowers.

HOST PLANTS: Eggs are laid on clumps of *Festuca idahoensis* Elmer (Gramineae) or on bare soil amongst them, and perhaps on other grasses. Larvae are easily reared without diapause on Bermuda Grass. The adult phenotype is constant under high rearing temperature and continuous light.

RECORDS: Deadfall Meadow (2) 16 VIII 79, 27 VIII 79, (22) 20 IX 79; Big Flat (3) 4 IX 76, (10) 8 IX 76, (2) 24 IX 77, (11) 30 IX 76; slope above Big Flat (34), 7 IX 76; Parker Meadow (18) 5 IX 76, (9) 1 X 76; Mumford Meadow (8) 5 IX 76; Parker Creek Trail, 6 IX 76; Dorleska Mine, 7 IX 76; Mount Eddy (3), 16 IX 78. (16 VIII - 1 X)

NOTE: Phenotypes of *sabuleti* from Crater Lake, Oregon, are similar, but these populations fly earlier, 16 VII - 27 VIII (Tilden and Huntzinger, 1977).

98. *Polites sonora* Scudder. Sonora Skipper.

This is a fairly common species on moist meadows and bogs, and is occasional on drier meadows. The ventral hind wing averages little if any darker than in the Sierra, but a few specimens from Mount Eddy and the summit bog on Scott Mountain are noticeably dusky. One brood, earlier than *P. sabuleti*. Visits *Aster*.

HOST PLANTS: Presumably Gramineae.

RECORDS: Eagle Creek (2), 14 VI 80; Coffee Creek, 800 m, 14 VI 80; Crawford Creek, 15 VI 80; Morris Meadow (3) 24 VI 76, 26 VI 76, (2) 4 VIII 79; Mumford Meadow (2), 25 VI 77; meadow at base of Packer's Peak Trail (4), 9 VII 77; bog at Scott Mountain Summit (4), 11 VII 77; Deadfall Lakes (2) 6 VIII 78, (5) 16 VIII 79, (3) 20 IX 79; Mount Eddy, 6 VIII 78; Dead Mule Camp (2), 5 IX 76. (14 VI - 20 IX)

99. *Hylephila phyleus* Drury. Fiery Skipper.

A stray from lower elevations; this species is one of the commonest weedy butterflies in California, almost completely restricted to man - modified habitats where it breeds on Bermuda Grass. The Trinities are near its northern limit. The Big Flat specimen was at *Haplopappus bloomeri*.

HOST PLANTS: Coffee Creek Ranger Station, 27 V 77; Hwy. 3 at Swift Creek, 10 VII 77; Big Flat, 30 IX 76. (27 V - 30 IX)

100. *Carterocephalus palaemon* Pallas. Arctic Skipper.

Frequent in moist, shaded streamside situations in canyons, from the foothills to about 1500 m. Trinity specimens are smaller than those from the well-known colonies in Sonoma and Mendocino Counties. The Arctic Skipper is unrecorded from Mount Eddy, but expected.

HOST PLANTS: Unknown; presumably grasses.

RECORDS: Canyon Creek (7), 28 V 77; Lone Jack, 28 V 77; Cecilville, 29 V 77; Crawford Creek, 29 V 77, 15 VI 80; Coffee Creek, 800 m, 14 VI 80; Stuart Fork below Sawtooth Ridge, 24 VI 76; Emerald Lake (3) 25 VI 76; Deer Creek, 27 VI 76; Morris Meadow, 26 VI 76; Coffee Creek, 1400 m, 26 VI 77. (28 V - 27 VI)

101. *Pholisora catullus* Fabricius. Sooty Wing.

Rather an unexpected casual; a species of disturbed weedy sites where the hosts grow. It occurs in Weaverville and in the dry bed of the Trinity River in summer, but is uncommon.

HOST PLANTS: Elsewhere on Chenopodiaceae and Amaranthaceae.

RECORDS: Lone Jack, 18 VI 77.

102. *Pyrgus ruralis* Boisduval. Montane Checkered Skipper.

Common in open montane to subalpine habitats, especially dry meadows, where it visits Pussy Paws (*Spraguea*). Trinity-Eddy specimens average smaller than Sierran ones, and there are slight but consistent pattern differences. One brood. (Two from Coffee Creek, 1400 m, are very large and unlike the others.)

HOST PLANTS: Rosaceae: *Horkelia fusca* Lindl. ssp. *parviflora* (Nutt.) Keck suspected.

RECORDS: Lone Jack (2), 28 V 77; Lion Lake trail, 13 VI 76; Eagle Creek, 14 VI 80; Union Creek, 14 VI 76; Deadfall Meadow, 15 VI 80; 6.5 km W Callahan, 15 VI 80; Willow Creek Meadow (2), 16 VI 76; Morris Meadow, 17 VI 76, (2) 26 VI 76; Sapphire Lake, 25 VI 76; Emerald Lake (2), 25 VI 76; Mumford Meadow (3) 25 VI 77; Coffee Creek, 1400 m (2), 26 VI 77; Deer Creek, 27 VI 76; base of Red Rock Mountain (2), 10 VII 77; Deadfall Lakes (5) 12 VII 79, (3) 6 VIII 78. (28 V - 6 VIII)

103. *Pyrgus communis* Grote. Common Checkered Skipper.

Frequent on wet to dry meadows on ultrabasic soils. Rare elsewhere. There are at least two broods. Males are extremely territorial; they visit flowers and mud.

These populations do not show the phenotypic oddities of high-altitude Sierran ones, and appear indistinguishable from Central Valley *communis*. Their edaphic restriction reflects the distribution of their hosts.

HOST PLANTS: Malvaceae: *Sidalcea oregana* (Nutt.) Gray ssp. *spicata* (Regel) Hitch. (ova and larvae, Mumford Meadow); *Malva neglecta* Wallr. (larva, Big Flat, 25 IX 77).

RECORDS: Coffee Creek (2), 27 V 77; Mumford Meadow, 14 VI 76, (14) 25 VI 77; Deer Creek, 27 VI 76; 3.2 km W Gazelle, 5 VII 80; Gulick Creek, 10 VII 77; Deadfall Lakes (4) 6 VIII 78, 16 IX 78; Sunrise Creek, 5 IX 76; Deadfall Meadow, 20 IX 79; French Creek (Scott Valley) (2), 21 IX 79. (27 V - 21 IX)

104. *Erynnis icelus* Scudder and Burgess. Dreamy Dusky-wing.

Apparently scarce, but widely distributed around willows at low to mid-elevations. Often found at puddles.

HOST PLANTS: Willows suspected.

RECORDS: Canyon Creek (2), 28 V 77; Lone Jack, 28 V 77; Scott Valley (2), 29 V 77; Coffee Creek, 800 m, 14 VI 80; Crawford Creek (2), 15 VI 80; 11 km E Callahan (2), 15 VI 80; Callahan, 15 VI 80. (28 V - 15 VI)

105. *Erynnis propertius* Scudder and Burgess. Propertius Dusky-wing.

Abundant and general where oaks occur; straying to above tree line. This species is probably single-brooded in our region, but has a very long flight season. It is a frequent visitor to *Monardella* flowers and to mud puddles. Males are highly territorial.

HOST PLANTS: Fagaceae: *Quercus garryana* Dougl. (Oregon Oak), probably other Oaks.

RECORDS: Lone Jack, 28 V 77; Canyon Creek (2), 28 V 77; Shadow Creek, 29 V 77; Scott Valley, 29 V 77; Cecilville, 29 V 77; Boulder Creek (2), 12 VI 76, 14 VI 76; Lion Lake trail, 13 VI 76; Union Creek, 14 VI 76; Coffee Creek, 800 m, 14 VI 80; Eagle Creek, 14 VI 80; lower Bear Basin Meadow, 15 VI 76; Crawford Creek, 15 VI

80; 11 km E Callahan, 15 VI 80; Callahan, 15 VI 80; 6.5 km W Callahan, 15 VI 80; Morris Meadow, 17 VI 76, 26 VI 76; Mumford Meadow (3) 25 VI 77; Emerald Lake, 25 VI 76; Coffee Creek, 1400 m, 26 VI 77; 3.2 km W Gazelle, 5 VII 80; Sunrise Pass (2), 10 VII 77; Deadfall Lakes, 12 VII 79; Mount Eddy summit (2), 6 VIII 78; upper Caribou Lakes Trail, 2000 m, 10 VIII 76; Gumboot Butte, 2048 m, 11 VIII 76. (28 V - 11 VIII)

106. *Erynnis pacuvius* Lintner. Pacuvius Dusky-Wing.

Uncommon. Our series, mostly from mud puddles, is too short for a confident subspecific determination. Geographically speaking, these should be *lilius* Dyar.

HOST PLANTS: Undetermined. *Ceanothus* spp. elsewhere.

RECORDS: Coffee Creek, 800 m, 14 VI 80; Eagle Creek (4), 14 VI 80; Coffee Creek, 1400 m, (2) 26 VI 77. (14 VI - 26 VI)

107. *Erynnis persius* Scudder. Persius Dusky-wing.

Persius is fairly widespread on dry meadows, mostly on ultrabasic soils in the Trinity-Eddy area. Like its relatives, it visits mud puddles; the autumn brood visits *Aster* and *Haplopappus bloomeri*. This is the only fully double-brooded Dusky-wing in the Trinities and Eddies.

HOST PLANTS: Unknown.

RECORDS: Canyon Creek (2), 28 V 77; Lone Jack, 28 V 77; Coffee Creek, 850 m, 29 V 77, 14 VI 80; Lion Lake trail, 13 VI 76; Crawford Creek, 15 VI 80; Mumford Meadow (4), 25 VI 77; Parker Meadow, 21 VIII 77; Dead Mule Camp, 5 IX 76; slope above Big Flat, 7 IX 76; Deadfall Lakes (4), 16 IX 78. (28 V - 16 IX)

108. *Thorybes pylades* Scudder. Northern Cloudy-wing.

Frequent, foothills to montane meadows, mostly in canyon riparian habitat, visiting flowers. This is the lowest-elevation member of the genus.

HOST PLANTS: Associated with *Lathyrus jepsonii* ssp. *californicus* (Wats.) Hitchc. at Morris Meadow, its highest station.

RECORDS: Coffee Creek, 850 m, 27 V 77, 800 m 14 VI 80; Canyon Creek, 28 V 77; Lone Jack, 28 V 77; Crawford Creek, 29 V 77, 15 VI 80; Scott Valley, 29 V 77; Morris Meadow (2), 26 VI 76. (27 V - 26 VI)

109. *Thorybes diversus* Bell. Scarce Cloudy-wing.

Rare. Thus far recorded only once, at the edge of a large sedgy meadow, sipping mud with the next species. A number of collectors have mistakenly reported *diversus* from the Trinity-Eddy area through confusion with *T. m. aemilia*. It may be recognized by the very plain, dark brown hind wing beneath, virtually lacking the dark bars and fine striations characteristic of *aemilia*.

In the Sierra Nevada, *diversus* is a mid-elevation species often found in small clearings rather than the large meadows.

HOST PLANTS: Unknown locally.

RECORDS: Mumford Meadow (3), 25 VI 77.

110. *Thorybes mexicana aemilia* Skinner. Emily's Cloudy-wing.

Emily's Cloudy-wing has long been confused with both the preceding species and with *T. m. nevada* Scudder of the Sierra Nevada. It differs from the latter in having a more boldly marked ventral hind wing often tinged with yellowish, and a usually more complete pattern of white spots on the fore wing (as figured in the last edition of Holland's *Butterfly Book*). Mount Eddy specimens are slightly larger

and darker than Trinity ones and are closer to a series from Three Creeks Meadows, 27 km S. Sisters, Deschutes Co., Oregon, sent by J. Hinchliff; Trinity ones are perhaps the most aberrant in the *mexicana* complex.

This is a very common to abundant species in the higher montane and subalpine meadows and bogs, mainly on ultrabasics; it is associated with *Phyciodes campestris*, *Agriades glandon*, etc. It does not seem to hilltop in the Trinities, but we have it from the very top of Mount Eddy.

HOST PLANTS: Unknown, but closely associated with *Trifolium* on the meadows.

RECORDS: Mumford Meadow, 14 VI 76, (18) 25 VI 77; Deadfall Meadow, 15 VI 80; Deer Creek, 16 VI 76, 27 VI 76; Morris Meadow (2), 17 VI 76, 24 VI 76, 26 VI 76; Gulick Creek (4), 10 VII 77; Deadfall Lakes (6), 12 VII 79, 16 VIII 79; Mount Eddy summit area (5), 6 VIII 78. (14 VI - 16 VIII)

111. *Epargyreus clarus* Cramer. Silver-Spotted Skipper.

Occasional in foothill and lower montane canyons. Common in Weaverville, where its naturalized host plant, *Robinia*, is used as a street tree. One brood. An avid visitor to flowers, especially Red Clover.

HOST PLANTS: Unknown in Trinities; at Weaverville, *Robinia*; usually on *Amorpha*.

RECORDS: Lone Jack, 28 V 77; Cecilville, 29 V 77; Eagle Creek, 14 VI 80; Coffee Creek, 800 m, (3) 14 VI 80, 1400 m, 26 VI 77; Hobo Gulch, 18 VII 77. (28 V - 18 VII)

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Fig. 3. Locations of Californian faunas compared in Tables 1-4. a, Trinity Alps; b, Mount Eddy; c, Yuba Pass; d, South Yuba River Country (Lang, Donner, Castle); e, Yosemite National Park, including Tioga Pass.

Table 1

Faunas of eight areas, drawn from various sources. The South Yuba River Country, parallel to Interstate 80, contains three subunits: Lang Crossing (montane, ca. 1500 m, including both xeric and mesic habitats), Donner Pass (high montane - subalpine, 2100 m), and Castle Peak (subalpine - alpine, 2700 m). Castle Peak is The next-to-last 2700 m peak in the northern Sierra (Shapiro, 1977). Tioga Pass is listed separately even though it is included in the Yosemite fauna, because it is the best-documented alpine fauna in the High Sierra. Clinal and otherwise ambiguous subspecies are generally omitted.

	1	2	3	South Yuba River Country			5	6
	Crater Lake National Park	Trinity Alps + Mount Eddy	Yuba Pass - Gold Lake Area	Castle Peak	Donner Pass	Lang Crossing	Yosemite National Park	Tioga Pass
<u>Danaus plexippus</u>	x	x	x		x	x	x	x
<u>Danaus gilippus</u>							x	
<u>Coenonympha tullia californica</u>			x		x	x	x	
<u>ampelos</u>			x		x			
<u>mono</u>							x	
<u>eryngii</u>	x	x						
<u>Cercyonis pegala ariane</u>							x	
<u>boopis</u>	x	x	x					
<u>Cercyonis sthenele silvestris</u>		x	x			x	x	
<u>Cercyonis oeta</u>	x			x	x		x	x
<u>Oeneis ivallda</u>				x	x		x	x
<u>Oeneis nevadensis</u>	x	x						
<u>Speyeria cybele leto</u>		x	x		x	x	x	
<u>S. nokomis apacheana</u>							x	
<u>S. zerene zerene</u>			x		x	x	x	
<u>conchylia</u>	x	x						
<u>malcolmi</u>							x	
<u>S. callippe inornata</u>			x		x	x	x	
<u>nevadensis</u>							x	
<u>rupestris</u>		x						
<u>semivirida</u>	x							
<u>S. egleis egleis</u>			x	x			x	x
<u>oweni</u>	x	x						
<u>S. hydaspe hydaspe</u>			x		x	x	x	
<u>purpurascens</u>	x	x						
<u>S. atlantis irene</u>			x		x		x	
<u>dodgei</u>	x	x						
<u>S. coronis snyderi</u>			x		x	x		
<u>simaetha</u>	x	x						
<u>S. mormonia arge</u>			x		x		x	x
<u>erinna</u>	x	x						
<u>Boloria epithore</u>	x	x	x		x	x	x	x
<u>Euphydryas chalcedona chalcedona/</u>								
<u>truckensis</u>		x	x			x	x	
<u>sierra</u>							x	
<u>uncertain ssp.</u>		x						

	Crater Lake National Park ¹	Trinity Alps + Mount Eddy ²	Yuba Pass - Gold Lake Area ³	Castle Peak	Donner Pass	Lang Crossing	South Yuba River Country ⁴	Yosemite National Park ⁵	Tioga Pass ⁶
<u>Euphydryas editha rubicunda</u>								x	
<u>nubigena</u> +									
<u>aurilacus</u>			x					x	x
<u>monoensis</u>								x	
<u>lawrencei</u>	x								
<u>colonia</u>		x							
uncertain ssp.		x							
<u>Chlosyne damoetas malcolmi</u>								x	x
<u>C. acastus</u>								x	
<u>C. palla</u>	x	x	x		x	x		x	
<u>C. hoffmanni hoffmanni</u>				x	x			x	
<u>segregata</u>	x	x						x	
<u>C. leanira</u>			x					x	
<u>Phyciodes campestris campestris</u>	x	x						x	
<u>montana</u>			x	x	x	x		x	x
"Great Basin"								x	
<u>P. orseis orseis</u>		x							
<u>herlani</u>					x				
<u>P. mylitta</u>	x	x	x		x	x		x	x
<u>Polygonia satyrus</u>		x				x		x	
<u>P. faunus rusticus</u>	x	x			x	x		x	
<u>P. zephyrus</u>	x	x	x	x	x	x		x	x
<u>Nymphalis milberti</u>	x	x	x	x	x	x		x	x
<u>N. californica</u>	x	x	x	x	x	x		x	
<u>N. antiopa</u>	x	x	x	x	x	x		x	x
<u>Vanessa annabella</u>	x	x	x	x	x	x		x	
<u>V. atalanta</u>	x	x	x		x	x		x	x
<u>V. virginiensis</u>	x	x	x	x	x	x		x	
<u>V. cardui</u>	x	x	x	x	x	x		x	x
<u>Precis coenia</u>	x	x	x	x	x	x		x	x
<u>Limenitis lorquini</u>	x	x	x		x	x		x	
<u>Limenitis weidemeyerii</u>								x	
<u>Adelpha bredowii californica</u>	x	x	x		x	x		x	
<u>Apodemia normo normo</u>		x			x	x		x	
<u>tuolumnensis</u>								x	
<u>Habrodais grunus</u>	x	x	x		x ⁷	x		x	
<u>Atlides halesus</u>				x ⁷		x		x	
<u>Strymon melinus</u>		x	x		x	x		x	
<u>Satyrium fuliginosum fuliginosum</u>				x	x			x	
"Trinity"		x							
<u>Satyrium behrii</u>	x		x		x			x	
<u>S. auretorum</u>			x			x		x	

	Crater Lake National Park ¹	Trinity Alps + Mount Eddy ²	Yuba Pass - Gold Lake Area ³	Castle Peak	Donner Pass	Lang Crossing ⁴	South Yuba River Country ⁴	Yosemite National Park ⁵	Tioga Pass ⁶
<u>Euphilotes battoides battoides</u>								x	
<u>oregonensis</u>	x							x	
<u>glaucou</u>								x	
<u>intermedia</u>		x	x		x	x			x
<u>E. speciosa</u>								x	
<u>Philotes sonorensis</u>			x			x			
<u>Glaucopsyche piasus</u>	x	x				x		x	
<u>G. lygdamus</u>	x	x	x	x	x	x		x	x
<u>Celastrina argiolus echo</u>	x	x	x	x	x	x			x
<u>Anthocharis sara sara</u>		x				x		x	
<u>stella</u>			x	x	x			x	
<u>flora</u>	x								
<u>A. lanceolata</u>		x	x			x		x	
<u>Euchloe hyantis</u>		x	x	x	x	x		x	
<u>E. ausonides</u>		x	x	x	x	x		x	
<u>Colias eurytheme</u>	x	x	x	x	x	x		x	x
<u>C. philodice eriphyle</u>		x			x			x	
<u>C. occidentalis chrysomelas</u>		x	x					x?	
<u>C. behrii</u>								x	x
<u>Zerene eurydice</u>								x	
<u>Nathalis iole</u>								x	
<u>Neophasia menapia</u>	x	x	x		x	x		x	
<u>Pieris beckerii</u>	x	x			x			x	
<u>P. sisymbrii</u>	x	x	x	x	x	x		x	x
<u>P. protodice</u>	x	x			x	x		x	
<u>P. occidentalis</u>	x	x	x	x	x	x		x	x
<u>P. napi microstriata</u>			x			x		x	
uncertain ssp.	x	x							
<u>P. rapae</u>	x	x	x		x	x		x	
<u>Battus philenor</u>			x ⁷						
<u>Papilio zelicaon</u>	x	x	x	x	x	x		x	x
<u>P. indra</u>			x	x	x	x		x	x
<u>P. rutulus</u>	x	x	x		x	x		x	x
<u>P. multicaudatus</u>		x				x		x	
<u>P. eurymedon</u>	x	x	x	x	x	x		x	x
<u>Parnassius clodius</u>	x	x	x	x	x	x		x	x
<u>P. phoebus behrii</u>								x	x
<u>sternitzkyi</u>		x							
<u>Epargyreus clarus</u>		x ⁷	x			x		x	
<u>Pholisora catullus</u>		x			x ⁷	x			
<u>Thorybes pylades</u>		x				x		x	
<u>T. mexicana nevada</u>			x	x	x	x		x	x
<u>aemilia</u>	x	x							

	Crater Lake National Park ¹	Trinity Alps + Mount Eddy ²	Yuba Pass - Gold Lake Area ³	Castle Peak	Donner Pass	Lang Crossing	South Yuba River Country ⁴	Yosemite National Park ⁵	Tioga Pass ⁶
<u>T. diversus</u>		x				x		x	
<u>Pyrgus ruralis</u>	x	x	x	x	x	x	x	x	
<u>P. communis</u>		x	x	x	x	x	x	x	
<u>Heliopetes ericetorum</u>			x			x		x	
<u>Erynnis persius</u>	x	x	x		x	x		x	
<u>E. icelus</u>	x	x	x			x			
<u>E. pacuvius lilius</u>	x	x	x			x		x	
<u>E. propertius</u>		x	x	x ⁷	x	x		x	
<u>E. zarucco funeralis</u>								x	
<u>Hesperia miriamae</u>								x	x
<u>H. nevada</u>				x	x			x	
<u>H. juba</u>	x	x	x	x	x	x		x	x
<u>H. columbia</u>		x							
<u>H. lindseyi</u>		x							
<u>H. harpalus harpalus</u>			x	x	x			x	x
<u> yosemite</u>			x		x	x		x	
<u> tildeni</u>		x							
<u> oregonia</u>	x	x							
<u>Ochlodes sylvanoides</u>	x	x	x		x	x		x	
<u>O. agricola</u>		x	x			x		x	
<u>Polites sabuleti sabuleti</u>					x ⁷			x	
<u> tecumseh</u>				x	x	x		x	x
<u> "Trinity"</u>	x	x							
<u>P. sonora</u>	x	x ⁷	x		x ⁷	x ⁷		x	x
<u>Hylephila phyleus</u>		x ⁷			x ⁷	x ⁷			
<u>Atalopedes campestris</u>		x			x ⁷	x			
<u>Lerodea eufala</u>						x ⁷			
<u>Paratrytone melane</u>		x						x	
<u>Amblyscirtes vialis</u>		x	x		x	x		x	
<u>Carterocephalus palaemon</u>	x	x	x						
Total taxa:	80	116	99	48	102	96	148	50	

Notes: ¹Tilden and Huntzinger 1977 plus museum records and Dornfeld 1980

²Present study

³Opler, unpublished; Shapiro, unpublished

⁴Shapiro, unpublished data

⁵Garth and Tilden 1963 plus O. Shields notes

⁶Tilden 1959 plus O. Shields notes

⁷definitely non-resident; strays

⁸Dornfeld's (1980) "form 1"

Table 2
Resemblances among the faunas in Table 1.

Above diagonal: Numbers of shared taxa
 Below diagonal: Sørensen's coefficient

	Crater	Trinity	Yuba	Castle	Donner	Lang	Yuba River (C+D+L)	Yosemite	Tioga
Crater		71	54	29	57	51	60	59	31
Trinity	0.724		71	31	69	76	83	83	31
Yuba	0.603	0.660		37	80	78	90	90	40
Castle	0.453	0.378	0.503		45	35		47	32
Donner	0.615	0.633	0.796	0.600		75		94	45
Lang	0.579	0.731	0.800	0.486	0.758			88	33
Yuba River (C+D+L)	0.588	0.667	0.807					112	46
Yosemite	0.502	0.629	0.725	0.480	0.752	0.721	0.823		
Tioga	0.477	0.374	0.537	0.653	0.592	0.452	0.529		

Crater		0.568	0.432	0.293	0.456	0.408	0.417	0.349	0.313
Trinity	0.888		0.493	0.233	0.463	0.559	0.529	0.459	0.230
Yuba	0.675	0.717		0.336	0.661	0.667	0.677	0.573	0.367
Castle	0.604	0.646	0.771		0.429	0.321		0.315	0.485
Donner	0.713	0.677	0.808	0.938		0.610		0.603	0.421
Lang	0.638	0.792	0.813	0.729	0.781			0.564	0.292
Yuba River (C+D+L)	0.750	0.716	0.909					0.700	0.359
Yosemite	0.738	0.712	0.909	0.979	0.922	0.917	0.903		
Tioga	0.620	0.620	0.800	0.667	0.900	0.660	0.920		

Above diagonal: Jaccard's coefficient of community
 Below diagonal: Simpson's index

Table 3

"Hudsonian" and "Arctic-Alpine" butterfly species recorded in four areas.

	Yosemite ¹	Donner-Castle ²	Trinity Alps ³	Mount Eddy ³
<u>Cercyonis oeta</u>	x	x		
<u>Oeneis ivallda</u>	x	x		
<u>Speyeria egleis egleis</u>	x	x		
<u>oweni</u>			x	x
<u>Speyeria mormonia arge</u>	x	4		
<u>erinna</u>				x
<u>Boloria epithore</u>	x	x	x	x
<u>Euphydryas editha nubigena</u>	x			
<u>colonia</u>			x	
<u>Euphydryas chalcedona ssp.</u>			x	
<u>Chlosyne damoetas malcolmi</u>	x			
<u>Chlosyne palla</u>	x			
<u>Phyciodes campestris campestris</u>			x	x
<u>montana</u>	x	x		
<u>Polygonia zephyrus</u>	x	x	x	x
<u>Nymphalis californica</u>	x	x	x	x
<u>Nymphalis milberti</u>	x	x	x	x
<u>Nymphalis antiopa</u>	x	x	x	x
<u>Vanessa cardui</u>	x	x	x	x
<u>Vanessa annabella</u>	x	x	x	x
<u>Vanessa virginiensis</u>		x	x	x
<u>Apodemia mormo mormo</u>	x		x	x
<u>Callophrys lemberti</u>	x	x	x	x
<u>Satyrium fuliginosum fuliginosum</u>		x		
"Trinity"			x	x
<u>Incisalia eryphon</u>	x	x		
<u>Incisalia iroides</u>			x	
<u>Lycaena heteronea</u>	x	x	x	x
<u>Lycaena rubidus</u>	x			
<u>Lycaena editha</u>	x	x		
<u>Lycaena mariposa</u>	x	x	x	x
<u>Lycaena nivalis nivalis</u>	x	x		
"Trinity" ⁵			x	x
<u>Lycaena phlaeas hypophlaeas</u>	x			
<u>Lycaena cupreus</u>	x	x		
<u>Lycaeides argyrognomon</u>	x	x	x	x
<u>Lycaeides melissa melissa</u>			x	x
<u>inyoensis</u>	x			
<u>Agriades glandon podarce</u>	x	x	x	x
<u>Plebeius saepiolus</u>	x	x	x	x
<u>Plebeius icarioides</u>		x		
<u>Plebeius shasta</u>	x	x		
<u>Plebeius acmon</u>	x	x	x	x
<u>Plebeius lupini</u>	x	x	x	x
<u>Everes amyntula</u>		x	x	x

	Yosemite ¹	Donner-Castle ²	Trinity Alps ³	Mount Eddy ³
<u>Euphilotes enoptes</u>	x	x	x	x
<u>Euphilotes battoides</u>	x			
<u>Glaucopsyche lygdamus</u>	x	x	x	x
<u>Celastrina argiolus echo</u>		x		
<u>Euchloe ausonides</u>	x	x	x	
<u>Euchloe hyantis</u>		x	x	x
<u>Anthocharis sara stella</u>		x		
<u>Colias eurytheme</u>	x	x	x	x
<u>Colias behrii</u>	x			
<u>Pieris sisymbrii</u>	x	x	x	x
<u>Pieris occidentalis</u>	x	x	x	x
<u>Papilio zelicaon</u>	x	x	x	x
<u>Papilio indra</u>	x	x	x	x
<u>Parnassius clodius</u>	x	x	x	x
<u>Parnassius phoebus behrii</u>	x			
<u>sternitzkyi</u>			x	x
<u>Thorybes mexicana nevada</u>	x	x		
<u>aemilia</u>			x	x
<u>Pyrgus communis</u>		x	x	x
<u>Pyrgus ruralis</u>		x		
<u>Hesperia miriamae</u>	x			
<u>Hesperia nevada</u>		x		
<u>Hesperia juba</u>	x	x	x	x
<u>Hesperia harpalus harpalus</u>	x	x		
<u>oregonia</u>			x	x
<u>Polites sabuleti tecumseh</u>	x	x		
"Trinity"			x	x
<u>Polites sonora</u>	x	x	x	x
Total taxa:	51	48	43	40

Notes:¹

Garth and Tilden 1963

²Shapiro, unpublished and 1977³Present study⁴residency not established; common in montane zone⁵Dornfeld's (1980) "form 1"

Table 4
Resemblances among the faunas in Table 3.

Above diagonal: Numbers of shared taxa

Below diagonal: Sørensen's coefficient

	Yosemite	Donner-Castle	Trinity Alps	Mount Eddy
Yosemite		38	28	26
Donner-Castle	0.768		29	30
Trinity Alps	0.596	0.637		39
Mount Eddy	0.571	0.682	0.939	

Yosemite		0.623	0.424	0.400
Donner-Castle	0.792		0.468	0.517
Trinity Alps	0.651	0.675		0.886
Mount Eddy	0.650	0.750	0.975	

Above diagonal: Jaccard's coefficient
of community

Below diagonal: Simpson's index

Table 5

Seasonal distribution of butterflies collected and seen in the montane, subalpine, and alpine Trinity Alps in 1976.

	June	July	August	Sept.
<u>C. t. eryngii</u>	_____			-
<u>Oe. nevadensis</u>	_____			
<u>C. p. boopis</u>	_____			
<u>C. s. silvestris</u>				_____
<u>D. plexippus</u>	_____			
<u>S. e. oweni</u>		_____		
<u>S. atlantis</u>			_____	
<u>S. c. rupestris</u>	_____			
<u>S. zerene</u>		_____		
<u>S. hydaspes</u>			_____	
<u>B. epithore</u>	_____			
<u>E. chalcidona</u>		_____		
<u>C. h. segregata</u>		_____		
<u>C. palla</u>	_____			
<u>P. campestris</u>	_____			
<u>P. mylitta</u>	_____			
<u>P. zephyrus</u>	_____			
<u>P. faunus</u>			_____	
<u>N. californica</u>	_____			-
<u>N. antiopa</u>	_____			
<u>V. annabella</u>			_____	
<u>V. virginiensis</u>	_____			
<u>P. coenia</u>	_____			
<u>L. lorquini</u>	_____			
<u>A. bredowii</u>	_____			
<u>A. mormo</u>				-
<u>H. grunus</u>		_____		
<u>S. fuliginosum</u>		_____		
<u>S. sylvinus</u>			_____	
<u>S. saepium</u>				_____
<u>I. iroides</u>				
<u>I. eryphon</u>	_____			
<u>C. lemberti</u>	_____			
<u>M. nelsoni</u>	_____			
<u>L. nivalis</u>	_____			
<u>L. mariposa</u>			_____	
<u>L. heteronea</u>			_____	
<u>L. arota</u>				-
<u>L. argyrognomon</u>	_____			
<u>P. icarioides</u>	_____			

Table 5

Seasonal distribution of butterflies collected and seen in the montane, subalpine, and alpine Trinity Alps in 1976.

<u>P. acmon</u>	_____
<u>P. lupini</u>	_____
<u>P. saepiolus</u>	_____
<u>A. glandon</u>	_____
<u>G. lygdamus</u>	_____
<u>G. piasus</u>	_____
<u>E. amyntula</u>	_____
<u>E. battoides</u>	_____
<u>E. enoptes</u>	_____
<u>C.a. echo</u>	_____
<u>P. rapae</u>	_____
<u>P. napi</u>	_____
<u>P. sisymbrii</u>	_____
<u>P. occidentalis</u>	_____
<u>A. lanceolata</u>	_____
<u>A. sara</u>	_____
<u>E. hyantis</u>	_____
<u>N. menapia</u>	_____
<u>C. eurytheme</u>	_____
<u>C. philodice</u>	_____
<u>P. phoebus</u>	_____
<u>P. clodius</u>	_____
<u>P. multicaudatus</u>	_____
<u>P. rutulus</u>	_____
<u>P. eurymedon</u>	_____
<u>P. zelicaon</u>	_____
<u>P. indra</u>	_____
<u>E. propertius</u>	_____
<u>E. persius</u>	_____
<u>E. icelus</u>	_____
<u>T. pylades</u>	_____
<u>T. mexicana</u>	_____
<u>P. ruralis</u>	_____
<u>P. communis</u>	_____
<u>C. palaemon</u>	_____
<u>H. juba</u>	_____
<u>H. harpalus</u>	_____
<u>H. phyleus</u>	_____
<u>A. campestris</u>	_____
<u>P. sonora</u>	_____
<u>P. sabuleti</u>	_____
<u>O. sylvanoides</u>	_____
<u>A. vialis</u>	_____

Appendix I

List of Trinity-Eddy Localities

All are mapped on the Redding and Weed sheets of the USGS 1:250,000 series. Topo maps (15' series) indicated by the following abbreviations: BK - Bonanza King; CC - Coffee Creek; ET - Etna; WV - Weaverville; TD - Trinity Dam; CEC - Cecilville; W - Weed; CM - China Mountain; HEL - Helena. Elevations approximate.

Bear Basin: NE of Seven-Up Peak; drains to Swift Creek via Bear Creek. 1800-2120 m. CC

Big Flat: major campground - trailhead on Coffee Creek Road at 1500 m. CC

Black Basin: NW of Seven-Up Peak, drains to Deer Creek. 1970-2273 m. CC

Black Mountain: Major hilltopping site S of Red Rock Mt., looking down on Ward Lake and upper Sunrise and Swift Creeks. 2430 m. CC

Bob's Farm: 4 km W of Upper Grizzly Meadows. 1620 m. CEC

Boulder Creek: Cub Wallow, 2211 m, to Coffee Creek, 900 m; deep V-shaped canyon open to N. CC (There is another Boulder Creek, 1500-1970 m, vic. Mount Hilton.)

Bridge Camp: Trailhead, lower Stuart Fork, 800 m. TD

Brown's Meadow: on Caribou Lakes Trail (new) NE of Little Caribou Lake; 1939 m. CC

Callahan: Jct. Scott River and Noyes Valley Creek, Hwy. 3, 32 km NNE of Big Flat, 875 m. Extensive Rabbitbrush in autumn. ET

Canyon Creek: Hwy. 299 to Canyon Creek Lakes (600-1725+ m), most collections above Ripstein Camp (900 m). South slope major canyon. HEL

Caribou Basin: 2120 m; N side Sawtooth Ridge, upper and lower Caribou Lakes, Snowslide Lake. Very cold subalpine basin with bogs and meadows on granite. CC

Caribou Lakes Trail (new): Big Flat (1500 m) to Caribou Lakes (2460 m), over flank of Caribou Mountain. Montane chaparral, coniferous forest, *Cercocarpus*, bogs. CC

Carrville: 731 m; serpentine chaparral on Hwy. 3, N end Trinity (Clair Engle) Lake. TD

Cecilville: montane coniferous forest; S Fork Salmon River, 695 m, North slope. CEC

Coffee Creek: Ranger Station, 725 m, to Carter's Resort, 1600 m; includes Big Flat. CC

Cold Spring: Stuart Fork near lower end Morris Meadows, 1268 m. TD

Crawford Creek: 1.6 km NE Cecilville (725-1450 m). CEC

Deadfall Lakes: 2180-2364 m; in basin surrounded by "arms" of Mount Eddy; boggy, subalpine. CM, W

Dead Mule Camp: upper end Parker Meadow (Swift Creek), 1545 m. CC

Deer Creek: Morris Meadow to Deer Lake, 1322-2300 m. TD

Dorleska Mine: 2060 m; below Preacher's Peak; tailings, *Eriogonum*, *Chrysothamnus*. CC

Dorleska Summit: 2135 m, just S of Preacher's Peak, above Yellow Rose Mine; colony of subalpine *Purshia*, unusual mineralogy. CC

Douglas City: 500 m; 18.2 km S Weaverville; foothill. WV

- Mount Eddy: 2738 (or 2750) m; highest ultrabasic point in state; 14.4 km WNW Mt. Shasta City; alpine. W, CM
- Emerald Lake: upper Stuart Fork drainage, granite, pink heather, subalpine, 1667 m. CC
- Foster's Cabin: at Dead Mule Camp, Swift Creek, 1545 m. CC
- Foster Lake: near Lion Lake; a source of Union Creek. 2300 m. CC
- Gazelle: 16 km W Dwinnell Reservoir, NW of Mt. Shasta, 834 m. I-5 at Callahan-Gazelle Road. Great Basin, irrigated alfalfa.
- Gibson Meadows: just below Granite Lake, 1750 m. TD
- Granite Creek: drains into Swift Creek; rises from a very low, N-facing snowfield; 2212-1212 m. TD
- Granite Lake: on Granite Creek, 1818 m. Granite and ultrabasic slopes. TD
- Grizzly Lake: below the Thompson Peak icefield (2728 m), alpine, bare granite (2152 m). CEC
- Grizzly Meadows: (upper and lower) 1697-1939 m, Grizzly Creek N of lake; boreal. CEC
- Gulick Creek: opposite Red Rock Mountain. Boggy, ultrabasic talus. 2030-1667 m. CC
- Gumboot Butte and Lake: 2048-1879 m; subalpine ultrabasics in Trinity Divide, 11.2 km E Hwy. 3. BK
- Hobo Gulch: North Fork Trinity River below Backbone Ridge on route to Papoose Lake, 909 m. HEL
- Josephine Lake: NE side of Sawtooth Ridge above Carter's Resort. Unnamed cirque at 2120 m above Lake. CC
- Lion Lake Trail: from Boulder Creek (1660 m) to 2120 m. CC
- Little Salt Creek: Tributary of Stuart Fork, rising from Siligo Peak (2473 m), collected 1152-1788 m. TD
- Lone Jack: Foot of Noonan Gulch, E Fork Trinity River, 636 m, 10.4 km N Helena. HEL
- Martin Gulch Fork: off Rattlesnake Creek, 8 km NW Papoose Lake, 1091-1364 m. CEC
- Mirror Lake: Hanging lake above Sapphire Lake, source of Stuart Fork. 2000 m. CEC
- Morris Meadow: very large meadows, wet and dry, on Stuart Fork, 1333-1430 m. TD
- Morgan Meadows: E side Mt. Eddy, 1500 m. W
- Mumford Meadow: large meadow on Swift Creek, 1606-1727 m. CC
- Packers Peak: Above Big Flat. Summit 2387 m. CC
- Papoose Lake Trail: from Backbone Creek to Papoose Lake, 900-2025 m. HEL
- Parker Creek Trail: from Parker Meadow to Parker Creek Divide (2100 m), ultrabasic, steep. CC
- Parker Meadow: large meadow on Swift Creek, 1515-1545 m. CC
- Red Rock Mountain: Summit 2395 m. Highest point in Red Trinities. Alpine, overlooking Sunrise Pass. CC
- Sapphire Lake: 1818 m; above Emerald Lake; subalpine granite. CC
- Sawtooth Ridge: divide between Stuart Fork and Caribou Basin; crest 2408 m; major hilltop area, snowfields on N side. CC, TD

- Scorpion Creek: W side Bonanza King opposite just N of Coffee Creek mouth, 900-1700 m. BK
- Scott Mountain: Hwy. 3 between Callahan and Trinity Center. Ultrabasic, with bog near summit at 1500+ m. CM
- Scott Valley: NNW of Callahan; Rabbitbrush abundant especially at French Creek (875 m). ET
- Shadow Creek: 9.5 km NE Cecilville; 865-1620 m. CEC
- Stuart Fork: Bridge Camp to Emerald Lake (800-1667 m). TD
- Sunrise Creek: Sunrise Pass to Swift Creek; ultrabasic; bog. 1695-2060 m. CC
- Sunrise Pass: S of Red Rock Mountain; head of Sunrise Creek; high subalpine, Fox-tail Pine. 2120 m. CC
- Swift Creek: Hwy. 3 to Horseshoe Lake (738 to 2182 m) via Mumford & Parker Meadows. Lower part forested. CC
- Thompson Peak: Highest point in Trinities (2744 m); alpine granite, snowfields. CEC
- Trinity Summit: French Gulch Road, lower montane coniferous forest (1152 m).
- Unity Creek Trail: Union Lake (1848 m) to Coffee Creek (1272 m), headwaters at Parker Creek Divide (2100 m). Ultrabasic, bogs, moraines. CC
- Willow Creek: 1970-1600 m; tributary of Deer Creek, 3.2 km NW Morris Meadow. TD
- Yellow Rose Mine Trail: Big Flat (1500 m) to Sunrise Pass (2120 m). Includes oak scrub, mine tailings; above Gulick Creek. CC

Appendix II

Species Lists for Trips after Mid-VII 1980

Deadfall Lakes, 24 VII 80:

Oe. nevadensis, *S. egleis oweni*, *B. epithore*, *C. hoffmanni segregata*, *P. campestris*, *N. californica* (hibernators), *P. coenia*, *L. lorquini*, *L. nivalis*, *I. eryphon*, *C. lemerti*, *E. enoptes*, *P. icarioides*, *P. saepiolus*, *C. eurytheme*, *P. sisymbrii*, *P. occidentalis*, *P. rapae*, *E. hyantis*, *P. zelicaon*, *P. clodius*, *P. sonora*, *P. ruralis*,

Mt. Eddy above upper Deadfall Lakes, 26 VII 80:

Oe. nevadensis, *S. egleis oweni*, *L. heteronea*, *C. lemberti*, *L. argyrognomon*, *P. saepiolus*, *P. lupini*, *C. eurytheme*, *P. sisymbrii*, *P. occidentalis*, *P. zelicaon*, *P. eurymedon*, *P. clodius*, *P. phoebus sternitzkyi*, *H. harpalus oregonia*, *E. propertius*.

Deadfall Meadow, 26 VII 80:

S. atlantis, *B. epithore*, *C. hoffmanni segregata*, *P. campestris*, *P. orseis*, *P. mylitta*, *P. zephyrus*, *L. lorquini*, *L. nivalis*, *E. battoides*, *C. argiolus echo*, *L. argyrognomon*, *P. saepiolus*, *P. icarioides*, *A. glandon*, *E. amyntula*, *C. eurytheme*, *P. occidentalis*, *P. zelicaon*, *P. eurymedon*, *P. clodius*, *P. sonora*, *P. communis*, *E. propertius*, *T. mexicana aerilia*.

Yellow Rose Mine Trail to Sunrise Pass, 27 VII 80:

Oe. nevadensis, *C. sthenele silvestris*, *S. atlantis*, *S. egleis oweni*, *S. hydaspe*, *C. hoffmanni segregata*, *E. chalcona* (subalpine), *P. campestris*, *P. zephyrus* (hibernator), *V. virginiensis*, *L. lorquini*, *L. nivalis*, *L. mariposa*, *H. grunus*, *S. saepium*, *S. fuliginosum*, *M. nelsoni*, *G. piusus*, *G. lydamus*, *C. argiolus echo*, *P. saepiolus*, *P. lupini*, *A. glandon*, *P. sisymbrii*, *P. occidentalis*, *P. rapae*, *E. ausonides*, *P. zelicaon*, *P.*

indra, *P. eurymedon*, *P. clodius*, *P. phoebus sternitzkyi*, *P. sonora*, *P. ruralis*, *E. propertius*, *T. mexicana aemilia*.

Coffee Creek Ranger Station, 27 VII 80:

Oe. nevadensis, *C. sthenele silvestris*, *P. rutulus*, *P. rapae*, *H. harpalus* near *tildeni*.

Scott Mountain summit, 27 VII 80:

C. sthenele silvestris, *S. atlantis*, *B. epithore*, *P. campestris*, *V. annabella*, *L. mariposa*, *L. argyrognomon*, *P. saepiolus*, *P. lupini*, *A. glandon*, *C. eurytheme*, *N. menapia*, *P. clodius*, *E. vestris*, *P. sonora*, *P. ruralis*, *E. propertius*.

Coffee Creek canyon, ca. 1200-1400 m, 27 VII 80:

Oe. nevadensis, *C. sthenele silvestris*, *S. callippe rupestris*, *S. hydaspe*, *P. mylitta*, *P. satyrus*, *N. californica*, *V. virginiensis*, *P. coenia*, *L. lorquini*, *A. bredowii*, *L. arota*, *S. sylvinus*, *M. nelsoni*, *E. enoptes*, *P. acmon*, *C. eurytheme*, *P. rapae*, *P. rutulus*, *P. eurymedon*, *P. clodius*, *O. sylvanoides*, *H. harpalus oregonia*, *P. sonora*, *E. propertius*, *E. pacuvius*, *T. mexicana aemilia*.

Mt. Eddy, 15 VIII 80:

S. atlantis, *S. egleis oweni*, *P. campestris*, *E. battoides*, *L. argyrognomon*, *P. saepiolus*, *E. amyntula*, *P. occidentalis*, *P. zelicaon*, *P. clodius*, *P. phoebus sternitzkyi*, *P. sonora*.

Callahan, 15 VIII 80:

P. mylitta, *S. saepium*, *L. melissa*, *P. acmon*, *C. philodice*, *P. occidentalis*, *A. campestris*, *P. communis*.

Scott Mountain summit, 2 IX 80:

C. tullia eryngii, *S. atlantis*, *O. sylvanoides*, *P. sabuleti*.

Callahan, 2 IX 80:

P. mylitta, *P. acmon* (1 aberrant), *L. melissa*.

Mt. Eddy, 3 IX 80:

S. atlantis, *S. egleis oweni*, *P. campestris*, *L. helloides*, *L. argyrognomon*, *L. melissa*, *P. saepiolus*, *E. amyntula*, *P. phoebus sternitzkyi*, *P. sabuleti*.

Callahan - Gazelle Road, 6 IX 80:

C. sthenele silvestris, *C. pegala boopis*, *C. tullia eryngii*, *P. mylitta*, *P. coenia*, *A. bredowii*, *L. melissa*, *C. philodice*, *C. eurytheme*, *P. beckerii*, *P. rapae*, *O. sylvanoides*.

Callahan, 20 IX 80:

C. sthenele silvestris, *C. tullia eryngii*, *S. zerene*, *P. mylitta*, *N. antiopa*, *V. annabella*, *V. cardui*, *P. coenia*, *A. bredowii*, *L. helloides*, *L. melissa*, *P. acmon*, *C. philodice*, *C. eurytheme*, *P. rapae*, *O. sylvanoides*, *A. campestris*, *H. juba*, *H. harpalus oregonia*, *H. columbia*.

Gazelle Mountain (Callahan - Gazelle Road), 20 IX 80:

D. plexippus, *C. sthenele silvestris*, *S. atlantis*, *S. zerene*, *P. mylitta*, *V. annabella*, *P. coenia*, *A. bredowii*, *L. arota*, *S. sylvinus*, *C. eurytheme*, *O. sylvanoides*, *H. juba*, *H. harpalus oregonia*, *H. columbia*, *P. sabuleti*.

Gazelle, 20 IX 80:

D. plexippus, *C. tullia eryngii*, *S. zerene*, *P. mylitta*, *P. satyrus*, *V. annabella*, *V. cardui*, *P. coenia*, *A. bredowii*, *L. helloides*, *S. melinus*, *L. melissa*, *P. acmon*, *C.*

philodice, *C. eurytheme*, *C. philodice* X *C. eurytheme* hybrids, *P. occidentalis*, *P. rapae*, *O. sylvanoides*, *A. campestris*, *H. harpalus oregonia*, *P. sabuleti*, *P. communis*.
Weed, 20 IX 80:

D. plexippus, *C. tullia eryngii*, *P. mylitta*, *P. zephyrus*, *N. californica*, *V. annabella*, *V. virginienensis*, *V. cardui*, *L. melissa*, *P. acmon*, *C. philodice*, *P. occidentalis*, *P. rapae*, *H. juba*, *P. sabuleti*.

Mt. Eddy, 21 IX 80:

L. melissa, *P. sabuleti*.

Deadfall Meadow, 21 IX 80:

S. atlantis, *S. zerene*, *P. zephyrus*, *N. milberti*, *P. mylitta*, *H. harpalus oregonia*, *P. sabuleti*.

Road 42N17 below Deadfall Meadow, 21 IX 80:

S. zerene, *C. philodice*, *H. harpalus*, *H. columbia*.

Scott Mountain summit, 21 IX 80:

C. tullia eryngii (common, fresh).

4.5 km E Gazelle, 4 X 80:

P. mylitta, *P. coenia*, *L. melissa*, *C. philodice*, *C. eurytheme*, *P. rapae*, *O. sylvanoides*, *A. campestris*, *P. sabuleti*, *P. communis*.

Mt. Eddy, 5 X 80:

S. egleis oweni, *P. phoebus sternitzkyi* (female).

Collectors: C. Kellner, M. Minno, D. Russell, A. M. Shapiro.

Appendix III

Notes on "The Butterflies and Some of the Moths of the Mt. Shasta Region,"
by F. X. Williams (1909)

This is the only faunistic paper to cover any place close to the Trinity-Eddy area. Williams penetrated the Trinity Divide and the Eddies, the Castella area, the McCloud River, and the headwaters of the Trinity River, but it is unclear just where. "Sisson" is the present Mount Shasta City. Williams gives a list of 87 species of butterflies. It should be remembered that this paper followed directly on the heels of W. G. Wright's *Butterflies of the West Coast*, filled with misdeterminations and taxonomic errors. Some of these are reflected in Williams' list. We here present his species list with equivalent modern names insofar as we have been able to determine them, and a few comments.

1. *Anosia plexippus* = *Danaus plexippus*.
2. *Argynnis leto* = *Speyeria cybele leto*. "Not uncommon at Sisson."
3. *Argynnis oweni* = *S. egleis oweni*.
4. *Argynnis zerene* = *S. zerene*.
5. *Argynnis monticola* = *S. hydaspe purpurascens*.
6. *Argynnis coronis* = *S. coronis*.
7. *Argynnis rupestris* = *S. callippe rupestris*. "In the valley."
8. *Argynnis epithore* = *Boloria epithore*.
9. *Melitaea chalcedon*. Identity uncertain. Reported as "very abundant in the valley... in June and early July." Wright's *chalcedona* is *chalcedona*.
10. *Melitaea palla* = *Chlosyne palla*.

11. *Melitaea hoffmani* = *C. hoffmani segregata*.
12. *Melitaea leanira* = *C. leanira*.
13. *Phyciodes pratensis* = *P. campestris*.
14. *Phyciodes mylitta*.
15. *Grapta satyrus* = *Polygonia satyrus*.
16. *Grapta faunus* = *P. faunus rusticus*.
17. *Grapta zephyrus* = *P. zephyrus*. Apparently "rare" because no collecting was done late in the season.
18. *Vanessa antiopa* = *Nymphalis antiopa*.
19. *Vanessa californica* = *N. californica*. Records "swarming" in 1902, rare 1907.
20. *Pyrameis caryae* (sic) = *Vanessa annabella*.
21. *Pyrameis cardui* = *V. cardui*.
22. *Junonia coenia* = *Precis coenia*.
23. *Limenitis lorquini*.
24. *Heterochroa bredowii* = *Adelpha bredowii californica*.
25. *Coenonympha brenda* = *C. tullia eryngii* or *california*.
26. *Satyrus ariane* = *Cercyonis pegala* ?*boopis*.
27. *Satyrus silvestris* = *Cercyonis sthenele silvestris*.
28. *Chionobas nevadensis* = *Oeneis nevadensis*. Seen in 1902 but not in 1907 (i.e., even-year populations).
29. *Thecla grunus* = *Habrodais grunus*.
30. *Thecla halesus*. Apparently accurate, as a stray? (*Atlides*.)
31. *Thecla m-album*. Whatever this is, it could not be *m-album*; it may be a female *Mitoura spinetorum*.
32. *Thecla melinus* = *Strymon melinus*.
33. *Thecla californica* = *Satyrium*, but probably *sylvinus* since said to be "quite" plentiful along the stream margins."
34. *Thecla saepium* = *Satyrium saepium*.
35. *Thecla nelsoni* = *Mitoura nelsoni*.
36. *Thecla iroides* = *Incisalia iroides*.
37. *Thecla eryphon* = *Incisalia eryphon*.
38. *Thecla dumetorum*: = *Callophrys*, species uncertain ("Canadian Zone").
39. *Chrysophanus virginianensis* = *Lycaena arota*.
40. *Chrysophanus gorgon* = *Lycaena gorgon*.
41. *Chrysophanus mariposa* = *Lycaena mariposa*.
42. *Chrysophanus zeroe* = *Lycaena nivalis*.
43. *Chrysophanus helloides* = *L. helloides*.
44. *Satyrium fuliginosa*.
45. *Lycaena heteronea*. Notes variability of females, some with blue.
46. *Lycaena fulla* = *Plebeius icarioides*.
47. *Lycaena saepiolus* = *Plebeius saepiolus*.
48. *Lycaena behrii* = *Glaucopsyche lygdamus behrii*.
49. *Lycaena sagittigera* = *Glaucopsyche piasus*.
50. *Lycaena podarce* = *Agriades glandon podarce*.
51. *Lycaena enoptes*. Uncertain; Wright's *enoptes* is *lupini*.
52. *Lycaena anna* = *Lycæides argyrognomon anna*.
53. *Lycaena acmon* = *Plebeius acmon*, but perhaps including *lupini* which is common in the area.

54. *Lycaena piasus*, based on Wright's plate, is *Celastrina argiolus echo*.
55. *Lycaena comyntas* = status uncertain. Apparent *comyntas* occur at Dunsmuir.
56. *Lycaena amyntula* = *Everes amyntula*.
57. *Neophasia menapia*.
58. *Pieris sisymbrii*.
59. *Pieris occidentalis*. (*P. protodice* also occurs in exceptional years.)
60. *Anthocharis lanceolata*.
61. *Anthocharis creusa* = *Euchloe hyantis*.
62. *Anthocharis sara*.
63. *Colias eurytheme*.
64. *Colias chrysomelas* = *C. occidentalis chrysomelas*.
65. *Parnassius clodius*.
66. *Parnassius smintheus hermodur* = *P. phoebus sternitzkyi*.
67. *Papilio philenor* = *Battus philenor*. Stray from below Dunsmuir.
68. *Papilio zolicaon* = *P. zelicaon*.
69. *Papilio indra*.
70. *Papilio eurymedon*.
71. *Papilio rutulus*.
72. *Papilio daunus* = *P. multicaudatus*.
73. *Carterocephalus palaemon*.
74. *Pamphila juba* var. *viridis* = *Hesperia juba*.
75. *Pamphila comma* = *H. harpalus oregonia*?
76. *Pamphila agricola* = *Ochlodes agricola*.
77. *Pamphila pratincola* = *O. sylvanoides*.
78. *Pamphila siris* = *Polites sonora*.
79. *Pamphila vestris* = *Euphyes vestris*.
80. *Amblyscirtes vialis*.
81. *Pyrgus tessellata* = *P. communis*.
82. *Pyrgus caespitalis* = *P. ruralis*.
83. *Thanaos persius* = *Erynnis persius*.
84. *Thanaos propertius* = *E. propertius*.
85. *Eudamus pylades* = *Thorybes pylades*.
86. *Eudamus aemilea* = *Thorybes mexicana aemilia*.
87. *Eudamus tityrus* = *Epargyreus clarus*.

Willians describes the distributions of these species according to Merriam's life zones, but adds perceptively that "a difficulty which the entomologist is apt to encounter in tracing out the zonal ranges of certain insects, if his hunting grounds are in a mountainous country and he arrives there in midsummer or late summer, is that the insects which he sees at high altitudes and appearing peculiar to that level, may in late spring or early summer frequent the valley region as well." He found 76.3% of our Trinity-Eddy species in four seasons.

